The Electrical Industry's Weekly Magazine

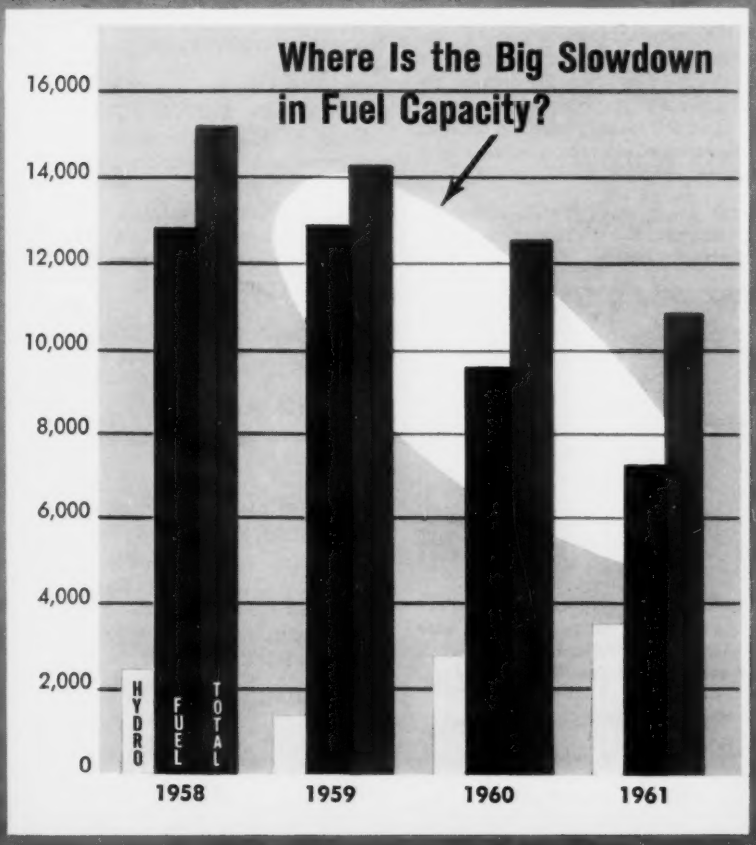
February 23, 1959

Electrical World

Price One Dollar

A McGraw-Hill Publication

ELECTRICAL WORLD INDUSTRY STATISTICS



55th Annual Report (Part 2)

The Electric of the Future Previewed in Syracuse . . .

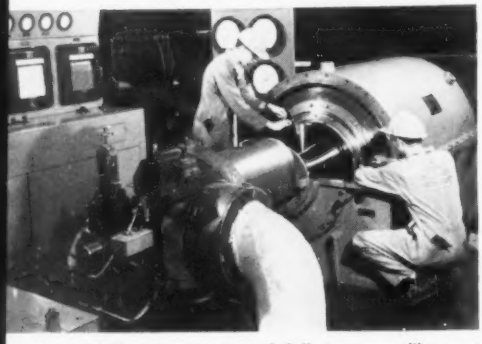
STEVENS RICE GS W
UNIVERSITY MICROFILMS IN
313 N 1 ST
ANN ARBOR MICH

How General Electric is developing better steam turbine-generator service

Engineering seminars held at factory by men like J. E. Downs, Mgr.—Turbine Engineering, inform field service representatives of latest advances. Average professional experience of each local G-E service representative is 17 years.

Completely integrated service—from initial order of a turbine-generator throughout its operating life—is an *added value* available to purchasers of General Electric steam turbine-generator units. Experienced field representatives and local specialists, backed by a headquarters Product Service organization form an integrated service effort designed to help electric utilities achieve more economical generation of electricity.

Here are some ways that G-E service helps maintain the product superiority built into each unit:



Laboratory testing of full-size parts like new thrust bearing (above), other continuing studies, confirm component design improvements.

INSTALLATION SERVICE STUDY TEAM helps simplify field erection by continually studying methods for reducing installation time and cost. It also seeks easier inspection procedures by suggesting appropriate improvements in equipment design.

PERFORMANCE INTERPRETATION helps owners evaluate abnormal sectional pressures and efficiencies, loss of capacity, and other operating irregularities. General Electric initiates tests to prove new designs, and aids owners in conducting their own performance tests on duplicate machines.

ENGINEERING CONSULTATION is continuously available from factory components. Here electrical and mechanical engineers specialize in providing prompt supporting attention to problems that may arise during the life of your unit.

MATERIALS AND PROCESSES LABORATORY ASSISTANCE is offered for any unusual service requirement. Nearly 300 physicists, chemists, specialists and technicians are available for field studies, consultation, and advanced nondestructive testing.

MAINTENANCE TASK FORCE establishes procedures to speed repairs and minimize outages by: assuring efficient repair routines, carefully analyzing shop operations to eliminate uncertainties, and coordinating our action with owner's requirements.

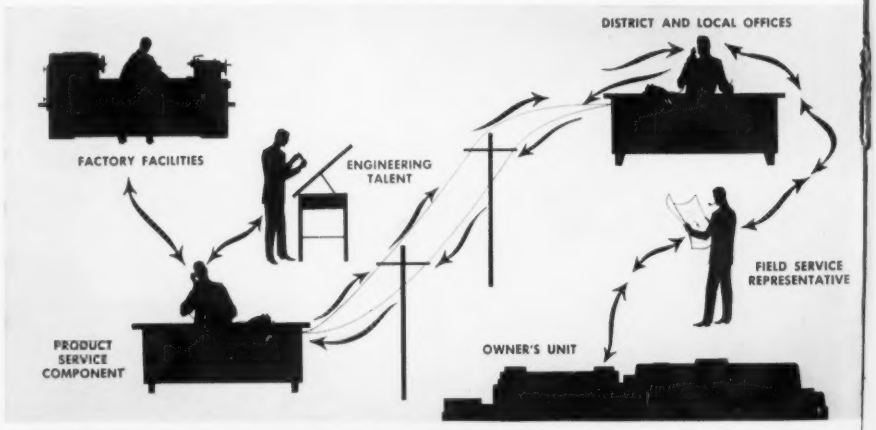
MATERIAL PROCUREMENT ADVANTAGES help reduce downtime. Large volume production, a backlog of currently approved materials such as composite forgings, tubing, and bar stock, and an efficient purchasing organization constitute power aids in meeting emergency requirements.

General Electric's integrated service program of KEEPING POWER MAKERS ON THE LINE provides a major *added value* that helps increase system efficiency and reliability, and reduce operating expenditures. For more information on this Program, contact your nearest G-E Apparatus Sales Office or write for Bulletin GED-3666 "Keeping Powermakers on the Line." General Electric Co., Section 301-392, Schenectady 5, N. Y.

MORE POWER TO AMERICA

GENERAL ELECTRIC

Engineering evaluation at plant site by G-E specialists improves installation time and costs.



Two-way flow of service information through Product Service component permits close liaison between factory personnel and field representatives on specific service problems.

Electrical World

Published for 85 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

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Here's look ahead at climate for debt and equity offerings by electric utilities.....p 137

MEETING

Eisenhower Speaks at NRECA Meet

Annual co-op convention draws 7,000 to Washington. Resolutions criticize Administration proposals.....p 76

Special Report

55th Annual Report

Electrical Industry Statistics—Part II

Special 32-page report pictures utility business as of January 1. Twelve pages of tables indicate specific plans for capacity expansion during next three years.

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Another reason why
UTILITIES EXPECT MORE FROM

POWERS American

ALL-NEW
Series EM-2
"Earth-Master"
HYDRAULIC HOLE DIGGER

THE ONLY PORTABLE DIGGER THAT DOES THE COMPLETE JOB

HANDLES THE WORK OF A "FIXED POSITION" BORING MACHINE... WITHOUT TYING UP A TRUCK JUST FOR DIGGING WORK!

Here at last . . . a portable digger that digs holes from 9″ to 30″ in diameter—up to 10′6″ deep, vertically or at various angles.

The EM-2, powered by a hydraulic pump utilizing the full torque of the truck engine, is designed for use with a "live boom" derrick such as the Series PM-2 "Pole-Master" Hydraulic Derrick shown in photos.

The unique digging head, providing low speed for digging and high speed for "spin off," is powered by a reversible hydraulic motor; also fed and raised by hydraulic power. It is rigidly guided at all times to assure straight, clean holes consistently—whether the soil is hard or soft, wet or dry.

When not in use the digger does not interfere with operation of the derrick. It can be stowed in special brackets on the derrick or can be easily removed for use on another vehicle.

Why not take a minute right now to send for complete details?

SERIES EM-1 . . . a smaller version of the EM-2 . . . digs holes to 9′4″ deep, from 9″ to 20″ in diameter.

SERIES DF-1 . . . has auger with Pengo head —in size for digging holes from 9″ to 20″ in diameter, up to 10′ deep.

Save time and money . . . let our sales and engineering staff analyze all your truck body and equipment needs.

McCABE-POWERS BODY COMPANY

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BERKELEY 10, CALIF.

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PORTLAND 2, OREGON

Electrical Dreamer's Club

"Why not reconsider your editorial policy in order to give an opportunity to both so-called experts and so-called crackpots to make a public test of their ideas? Really vulnerable ideas hold no terror for really sound ideas. As a bonus we might gain some really good ideas which we 'experts' never thought of."

Well, Mr. Sangster, we think you have a good idea here. In fact, four highly intelligent dreamers considered this at the lunch table during the recent A.I.E.E. Winter Meeting. We discussed ideas such as the electric automobile and a 12-v house circuit for the home to supply small night lights, toys, etc.

In fact, a dreamer called Hibben has just written a memorandum covering the birth of the Electrical Dreamer's Club. In this he proposes a special "Crackpot Division."

With such enthusiasm for the full recognition of new ideas, we now open the membership rolls to the "Electrical Dreamer's Club." Admission fee is one good idea for publication. Now you dreamers take the wraps off your ideas and join either division.

Fischer Black

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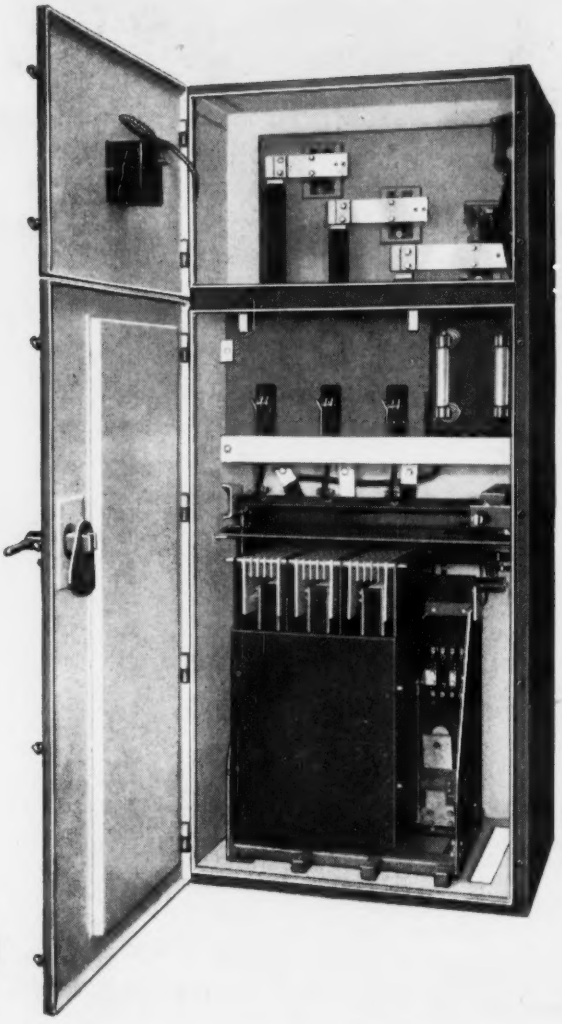
NEW EC&M STARTER

GIVES 100/150 MVA fault protection



WITHOUT FUSES!

Proven by tests conducted by an independent testing station, EC&M's new "fuseless" ZHA air-break starter has a certified interrupting capacity of 100,000 KVA at 2400 volts, 150,000 KVA at 4800 volts. This starter is simpler and much more accessible for inspection and checking connections.

The ZHA starter is not subject to problems associated with fuses. Single phasing due to blown fuses is eliminated...no costly replacement fuses to stock.

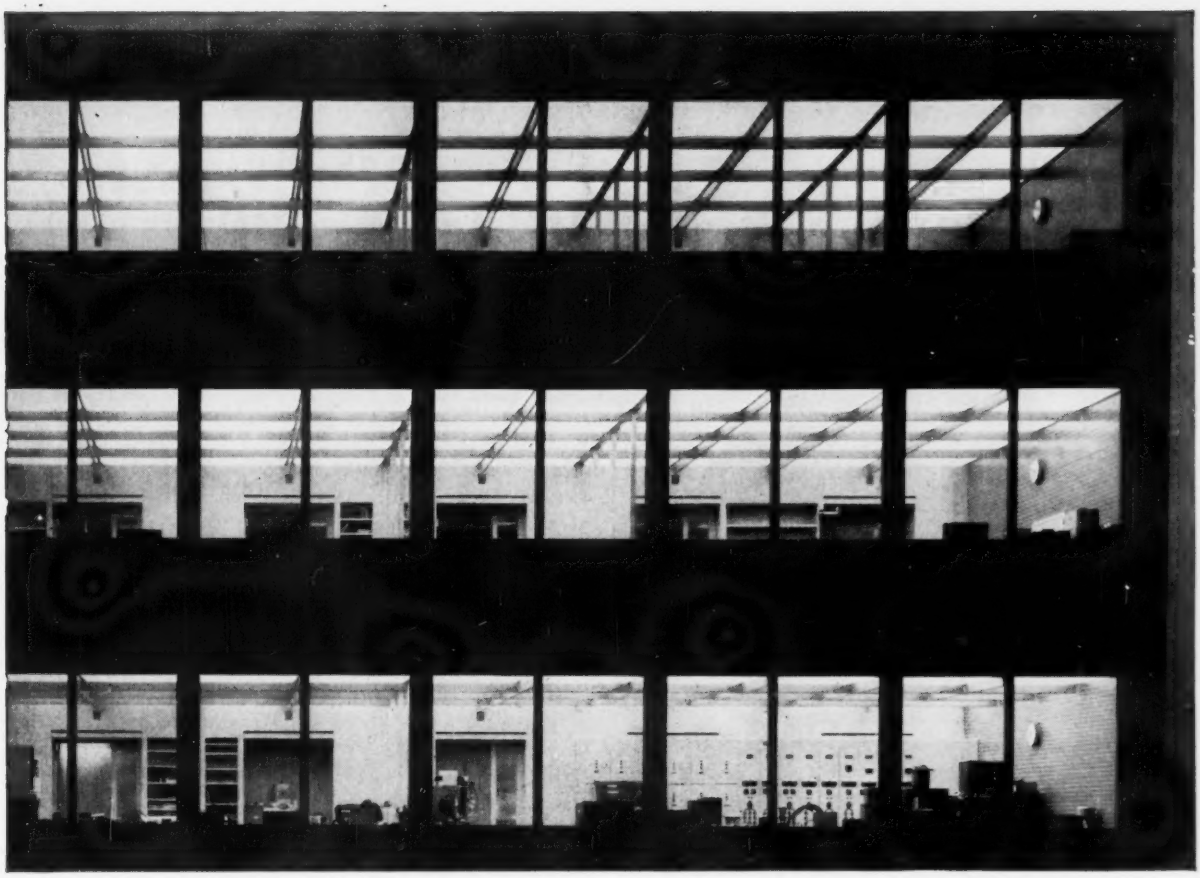
For positive personnel safety, the ZHA is equipped with a 3-way doorlatch, interlocked between disconnect switch and contactor interlocking system. The disconnect switch is gang-operated. When the door is open, disconnect blades are *visible* in the open and grounded position.

No roll-out needed...phase barrier and arc-chutes draw out horizontally, making front and rear contact tips readily accessible. Bus bars are used for power connections throughout the starter. Redesigned arc-chutes and interphase barrier, and improved contactor are additional features which make the ZHA starter your logical choice for high-voltage motor drives.

***GET THE COMPLETE STORY** on certified fuseless fault protection for high-voltage motor drives. Write for Bulletin 8130*

THE ELECTRIC CONTROLLER & MFG. CO.
A DIVISION OF THE SQUARE D COMPANY
CLEVELAND 28 • OHIO

2320



When you are asked to help out with a customer's lighting problem, you'll find us ready and willing to discuss with you the latest ideas, methods and information available from any one source,—Graybar!

For assistance in the selection of equipment for any lighting system . . .

MERCURY ☐ INCANDESCENT ☐ or FLUORESCENT ☐

. . . call Graybar

Every working day brings you questions from architects, electrical contractors, commercial establishments and industrials concerning the right lighting source and equipment to use for some particular installation. Always remember, you can supplement your own broad knowledge and experience through that of our Lighting Specialists,—men who have contributed to the planning of thousands of installations across the country. Graybar's roots are deep in the lighting industry, and ours is a mutual interest – better lighting for all.

Next time you have a knotty lighting problem, call your nearby Graybar office. Back up your dealers and contractors with the best of the current ideas selected from up-to-date developments of the nation's leading equipment manufacturers whom Graybar represents. You'll help build your load through the kind of lighting that will contribute to better production schedules in industry, greater sales for your merchant customers, and greater living enjoyment in homes in your area.

690

CALL **GraybaR** FIRST FOR

GRAYBAR ELECTRIC COMPANY, INC., 420 LEXINGTON AVENUE, NEW YORK 17, NEW YORK, IN OVER 130 PRINCIPAL CITIES

More than your Dollar's Worth

VICTOR No. 730
High Strength Switch & Bus Insulator (EEI-NEMA 58-8)

VICTOR Switch & Bus Insulators

The No. 730 insulator illustrated above is specially designed for use as stacking units. Because of its great strength characteristics, however, many power men use the No. 730 only as the bottom unit of a stack. It has extra large heavy duty shells (18" diameter), over-size 4-bolt cap and 6¼" bearing surfaces on both cap and pin for extra strong stacking service. Indication of its specialized design and construction is shown by its rated strength characteristics: Tensile strength: 25,000 lbs. Torsional strength: 90,000 lbs. Compression strength: 75,000 lbs.

MARGIN OF SAFETY

VICTOR makes sure that its No. 730 insulators not only meet but exceed EEI-NEMA specifications. This isn't idle boasting. We give these insulators a real beating in our electrical and mechanical labs. In fact, under electrical load, the No. 730's have withstood mechanical stresses far above their required ratings before destruction. This margin of safety means the difference between performance and failure during an emergency. It is one big reason for choosing VICTOR . . . and why more and more power men are doing just that.

WELL STACKED

As many as seven VICTOR No. 730 insulators may be used in stacking applications. The principal advantage, regardless of the number used in a stack, is strength. Take cantilever strength values as an example. When four No. 730's are stacked, rated cantilever strength is 2000 lbs. When seven are used, the rated value is 1000 lbs. And don't forget—VICTOR No. 730 insulators far exceed their EEI-NEMA ratings in tests in our electrical and mechanical laboratories. This assures any sub-station of a margin of safety that guarantees operational continuity.

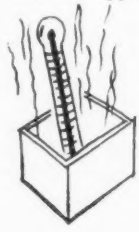
CLAY GIVES US THE SLIP

The raw clays used to make Purified Porcelain are first blended in water to form what is known in the industry as clay slip. Proper preparation of clay slip is a long and costly process but is essential for porcelain of fine texture and top quality and high strength. The ball clays are pre-washed and refined before other ingredients are added. This pre-washing is done in a special agitating machine called a blunger. Here, as in all other mixing operations, specially treated, demineralized water is used.

The ball clay is then pumped into a second blunger where accurately weighed amounts of china clays, flints, and feldspars are added. After further refining, the mix or slip goes into a third agitator, a storage agitator, from which it is pumped into the filter presses where most of the water is extracted.

2300° HOT BOX

After glazing, VICTOR insulators are fired in tunnel kilns. Kiln temperatures are maintained by use of modern automatic control instruments. Kiln cars equipped with silicon carbide refractories are loaded with unfired porcelain and moved continuously through controlled heat areas. The temperature in a kiln increases until it reaches approximately 2300° F. It then gradually becomes lower as the cars approach the exit. For full specifications and details on VICTOR high strength Switch and Bus Insulators, write I-T-E Circuit Breaker Company, Victor Insulators Division, Victor, N. Y.



I-T-E CIRCUIT BREAKER COMPANY
VICTOR INSULATORS DIVISION

• Southwire Galvanized Steel Strand

STRAND SIZE	5/8"	1/2"	7/16"	3/8"	5/16"	9/32"	1/4"	3/16"
WEIGHT PER 1000'	813 lb.	517 lb.	399 lb.	273 lb.	205 lb.	164 lb.	121 lb.	72.9 lb.
MINIMUM BREAKING STRENGTH IN POUNDS								
ASTM A-122-54T								
Galvanized (Single Galv.) Common	11600	7400	5700	4250	3200		1900	1150
Class A (Double Galv.) Common	11600	7400	5700	4250	3200		1900	1150
Class A (Double Galv.) Siemens-Martin	19100	12100	9350	6950	5350	4250	3150	1900
Class A (Double Galv.) High Strength	29600	18800	14500	10800	8000	6400	4750	2850
Class A (Double Galv.) Extra High-Strength		26900	20800	15400	11200	8950	6650	3990
Class A Utilities Grade, A.T.&T. and Western Union Spec.—7-wires		25000	18000	11500	6000*	4600		2400**
ASTM A-363-55T (No welds)								
Weldless High-Strength		18800	14500	10800	8000			
Weldless Extra High Strength		26900	20800	15400	11200			

*weight per 1000'—225 lbs. **weight per 1000'—80.3 lbs.

The infinite patience and skill used by the seafarer in stranding or splicing rope is matched by modern machines at Southwire.

Southwire Galvanized Steel Strand is manufactured to meet or exceed applicable ASTM specifications . . . and preformed to eliminate flared ends when sheared. Quality is our first concern, including premium-quality non-returnable reels on all reel shipments. Available in 250', *500' and 1,000' coils, 2,500', *5,000', 5,280' reels. Feel free to inquire about special packaging to suit your particular requirements.

Specify Southwire Galvanized Steel Strand for ground, messenger and guying applications, *shipped by our own fast fleet of trucks direct to your warehouse or jobsite.*

*Stock items

Southwire Company

Carrollton, Georgia—TErrace 2-6311

- Bare and Weatherproof Copper and Aluminum Line Wire
- Neoprene, Polyethylene, and VWP (Vinyl) Weatherproof Copper, Aluminum and Triplex
- U.R.C. (DBWP, TBWP) Copper
- Copperweld® Conductors
- Copper and Aluminum Building Wire
- ACSR and All Aluminum Cable
- Galvanized Steel Guy Strand and Static Wire
- Aluminized Steel Guy Strand and Static Wire
- Aluminum Alloy Wire
- Cable Accessories
- NM Sheathed Cable

• ALSO FABRICATORS OF COPPER AND ALUMINUM FOR WIRE AND CABLE MANUFACTURERS

A message of interest to users of Solenoids

This amazing consistency is due to BUSS Engineering.

DETROIT COIL COMPANY
Manufacturers of Direct Industrial Solenoids

8430 MILTON ROAD
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FERNDALE
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Sept. 29, 1958

Bussmann Mfg. Division
McGraw-Edison Company
St. Louis 7, Mo.

Gentlemen:

In the development of any product, accelerated endurance tests are of the utmost importance. Since our test facilities run unattended for a considerable period of time, it was always an unknown factor when a breakdown occurred; and whether the breakdown was the result of an electrical or a mechanical cause. Since our introduction of Fusetron fuses to this test equipment, we have eliminated this unknown.

For this test work, we need a protective device permitting normal operation of the solenoid, but in the event of mechanical or electrical breakdown, stop the test at a stage where the cause for failure could be examined before the evidence was destroyed.

Approximately two years ago, we started using Fusetron fuses on these tests. We found them to have an amazing consistency in their rating. Since then, where the proper size Fusetron fuses were used, it has been possible for us to determine the direct cause of electrical breakdowns.

We believe that if Fusetron fuses of proper size were generally used in the field, a great deal of coil replacement could be avoided — and resultant costly shutdowns, required while a solenoid is being repaired or replaced, would be eliminated.

This would be a boon to our service department, too, as it would cut down the number of service calls we have to make where the problem is not directly due to failure of the solenoid.

We feel that general use of the Fusetron fuse protection for solenoids would help both our customers and ourselves.

The size Fusetron fuse we use on normal applications is generally about 125% of the holding current rating of the solenoid.

Yours very truly,

DETROIT COIL COMPANY

E. A. Viale

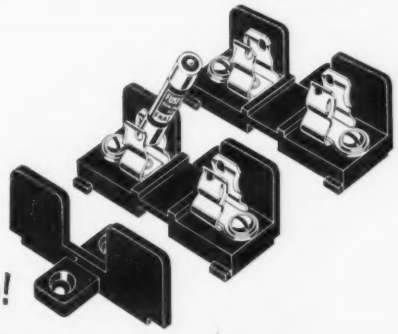
E. A. Viale
Vice President

EAV-g

"A Great Deal of Coil Replacement could be avoided, and Resultant Costly Shutdowns Eliminated by Protecting Solenoids *with* FUSETRON FUSES."

E. A. Viale, VICE PRESIDENT
DETROIT COIL COMPANY

Protecting solenoids or other electrical equipment with FUSETRON Fuses—gives you greater safety, dependability and money-savings!



The BUSS Add-On Fuse Block for the protection of solenoids or Small Motors on Multi-Circuit Equipment

The BUSS Add-On fuse block makes it easy to protect equipment of any kind where a number of solenoids or motors are used.

Blocks are made up of single pole fuse blocks that interlock into a unit fuse block of any number of poles.

Poles may be added or removed . . . to either end of assembled fuse block. This makes it simple to have a fuse block of just the number of poles needed and to fit the block to available space.

Each fuse can be used as a circuit disconnect.

Specially designed fuse clips permit one end of fuse to be removed from clip and fuse raised to right angle to block where it is held firmly in position — see picture above.

When working on machine this makes it quick to identify circuit that is open — and it assures that proper fuse will be put back in right circuit.

Write for BUSS Bulletin BL-1.

BUSS and FUSETRON fuses are available to fit these fuse blocks in ampere sizes up to 30 and for voltages up to 250. Write for BUSS Bulletin SFB.

FUSETRON dual-element fuses provide 10 point protection against electrical troubles—unlike circuit breakers or ordinary fuses which, except in rare cases, protect only against short-circuits.

Fusetron Fuses remain safe — with no maintenance or recalibration required. They are calibrated at the factory by engineers. Once properly installed, they require no inspection and resulting downtime necessary on mechanically operated devices. There are no hinges, pivots or contacts to stick or get out of order. Dust, corrosion or oxidation cannot increase a Fusetron fuse's capacity or lengthen its blowing time.

After years of inactivity, a Fusetron fuse will give the same safe, dependable protection if called upon to open as it would have on the day it was installed.

For more information, write for . . . Bulletin FIS on Fusetron Fuses.

Bussmann Mfg. Division, McGraw-Edison Co., St. Louis 7, Mo.

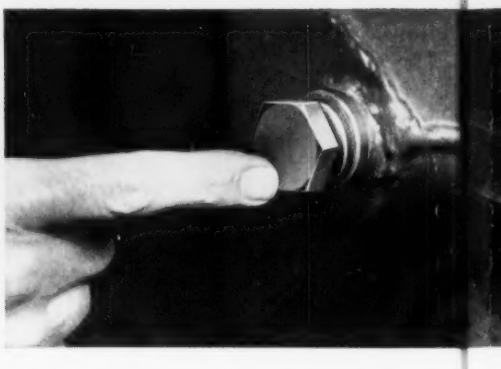
250

Play Safe! Install Fusetron dual-element fuses throughout entire Electrical System.

FUSETRON BUSS — TRUSTWORTHY NAMES IN ELECTRICAL PROTECTION — McGRAW EDISON — BUSSMANN MFG. DIVISION · St. Louis 7, Mo.

FULL DRAIN VALVE, with auxiliary oil sampling valve, will drain the tank completely. Sampling is more accurate.

LIQUID ACTUATED THERMOMETERS. More accurate and dependable than thermometers actuated by a coiled bi-metal strip.



LEAK PROOF MOUNTING BOSSES. For wells and radiator drain plugs. Serrated surfaces make annular grooves in the copper gasket. Fully leak proof.

SMALL DETAILS--but they ADD UP to better performance... easier maintenance for

WAGNER POWER TRANSFORMERS

Even the smallest details get plenty of attention when Wagner builds power transformers. That's one of the *little* reasons Wagner Transformers give such long, completely dependable service.

Here are a few of the *big* reasons:

WAGNER TRANSFORMER WINDINGS, in general, are disk type for high voltage, and helical type for low voltage. They are best suited to obtain rigid bracings and provide low temperature gradients.

WAGNER LEADS AND TAPS are solidly supported for safe electrical clearance and mechanical strength by firmly positioned bakelite tubes or strong clamps.

WAGNER TANKS are designed and built to withstand operating pressures, with heavy structural steel end and side braces spaced to eliminate low frequency audio noises. All seams are made by a fully automatic welder.

Consult Wagner about your next power transformer requirements. Your nearby Wagner Sales Engineer is at your service. Call him or write us.

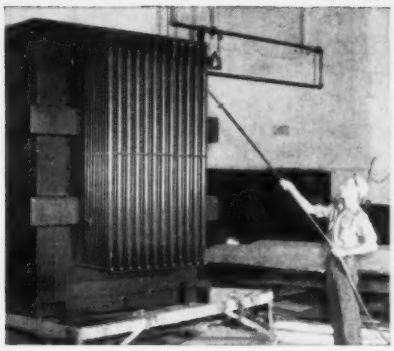
Wagner Electric Corporation

6456 PLYMOUTH AVENUE, ST. LOUIS 14, MISSOURI

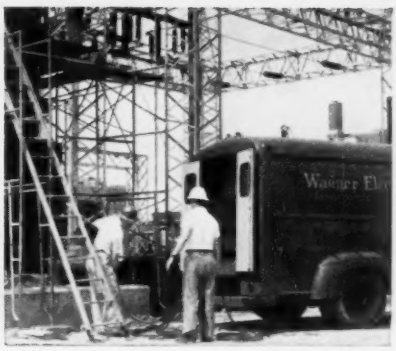
SERVING 2 GREAT GROWTH INDUSTRIES . . . ELECTRICAL – AUTOMOTIVE

WT59-5

SMOOTH UNIFORM WELDS. Submerged electro-arc melt welds penetrate deeply, are exceptionally smooth and uniform.



LONGER LASTING FINISH. New formula "Sure Seal" tank finish withstands all temperature changes—is much longer lasting in corrosive atmospheres.



FIELD REPAIR SERVICE. Wagner substation transformer service trucks, manned by expert field repairmen, are available on schedule.

BRANCHES AND DISTRIBUTORS IN ALL PRINCIPAL CITIES

This single phase Wagner Transformer is rated 15,000 kva. High voltage: 230,000 Grd. Y/132,800 volts. Low voltage: 6900 Delta volts.

Specially Designed RILEY Efficiently Fire Multiple Fuels

Inside the Turbo Furnace at Sterlington Steam Electric Station of Louisiana Power and Light Co. Overall width 54′—7⅞″, depth 24′—0-3/16″. No. 1 firebrick rubble covers the furnace floor. Twenty Riley Directional Flame Burners are arranged for opposed firing on front and rear walls. Burners are shop fabricated assemblies. Burner close-up shows directional vanes, two

The Riley TURBO FURNACE unit is one of the major furnace design advances in recent years for the more efficient utilization of fuels. It is known as a multifuel unit primarily because of its ability to produce similar furnace exit gas temperatures with gas, oil, coal or other solid fuels. This phenomenum is due to the fact that natural gas, which ordinarily burns with a non-luminous flame, burns in a TURBO FURNACE with a luminous flame similar to oil and coal. In a TURBO FURNACE, fuels are burned with extremely high turbulence at the furnace bottom; in the case of pulverized coal, over a slag pool. Much of the unusual combustion efficiency is due to opposed firing with Riley Directional Flame Burners specially designed for firing multiple fuels singly or in combination. These fuels may be pulverized coal, oil, gas, or other special solid fuels such as fluid coke or lignite.

Water Cooled Burner

The Riley Directional Flame Burner is designed for opposed firing on one level. Each Riley Directional Flame Burner is installed as a unit complete with water cooling tubes which are welded to the waterwall circulation system. The waterwall tube arrangement provides maximum cooling of directional vanes, nozzles and other burner parts and reduces to a minimum the possibility of slag adhesion when coal is being burned. No burner refractories are required.

Coal Burning

Two or three burner nozzles per burner are provided when coal or other solid fuels are to be burned. In this way the coal streams are more evenly distributed across the furnace to assure good mixing of fuel and air in the furnace.

Oil Firing

A retractable type oil gun is inserted thru the center slot so as to provide complete mixing of the spray with the air stream. Oil can be burned with either steam or mechanical atomizing equipment.

Gas Firing

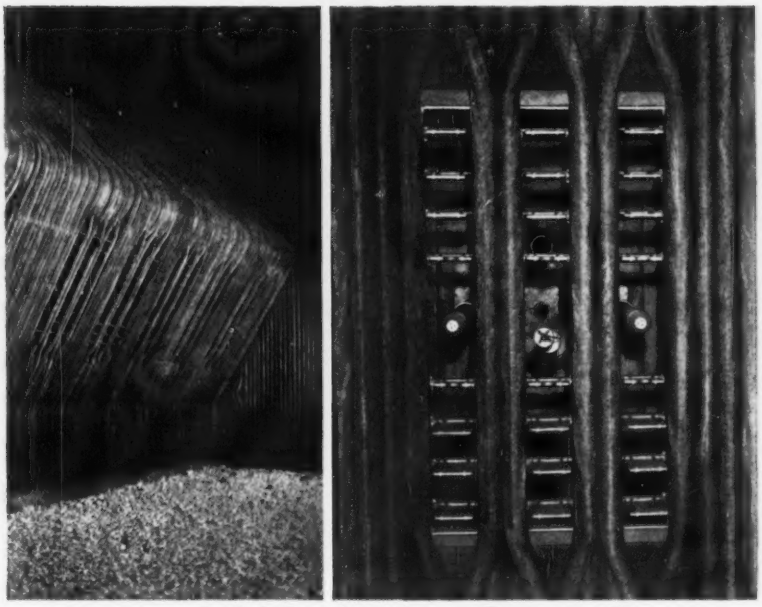
Gas is fired thru guns of high alloy stainless steel. High capacity burners have a gun in each side slot. Gas guns can be installed for mechanical retraction.

A RILEY TURBO FURNACE GIVES YOU THESE MONEY-SAVING ADVANTAGES

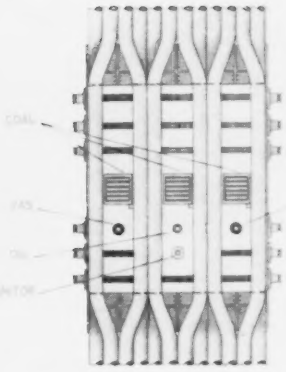
- **The ability to fire multiple fuels: gas, oil and a wide range of solid fuels**
- **A low cost and quick conversion to solid fuels with initial gas/oil firing**
- **Higher heat release with lower overall structure**
- **When firing coal**
  low carbon loss
  clean furnace, no slagging
  elimination of flyash removal with reinjection
- **One level burner operation**

TWENTY THREE RILEY TURBO FURNACE UNITS HAVE BEEN SOLD SINCE ITS INTRODUCTION IN LATE 1954!

Directional Flame Burners in a RILEY TURBO FURNACE



gas guns, gas electric ignitor, observation port. Burner can easily be converted to oil and coal firing.



RILEY
DIRECTIONAL FLAME BURNER
Pulverized Coal, Oil and Gas

Directional Vanes

Each slot is provided with directional vanes to project secondary air into the furnace so as to secure the desired placement of flame for most effective combustion. The vanes above the burner centerline and those below each have separate controls. Vanes are made of high heat resisting alloy.

Burner Shut-Off

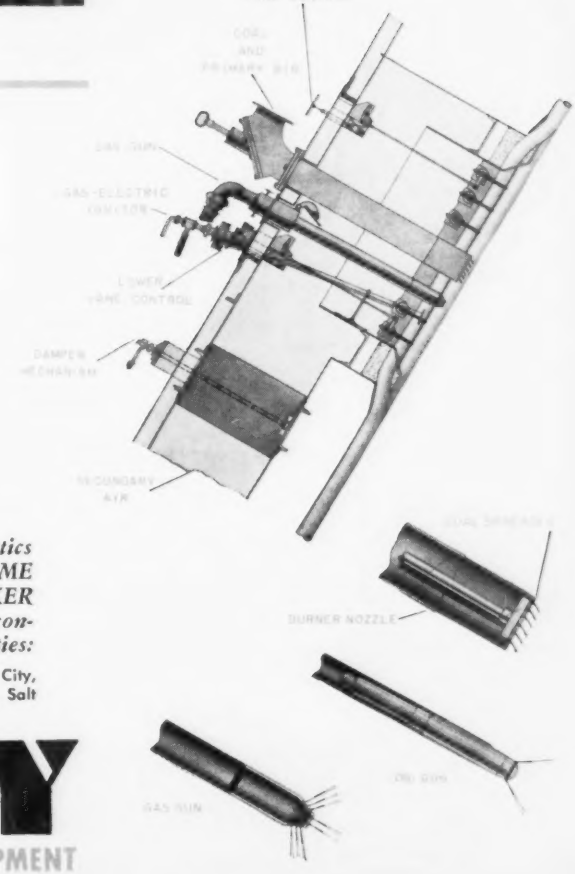
Each burner has a separate secondary air shut-off damper which can be locally or remotely controlled.

Riley Gas-Electric Ignitors

Riley Gas-Electric Ignitors are available with Riley Directional Flame Burners.

Pressurized and Non-Pressurized Operation

Riley Directional Flame Burners are designed so that they can be used either with pressurized or non-pressurized furnaces.



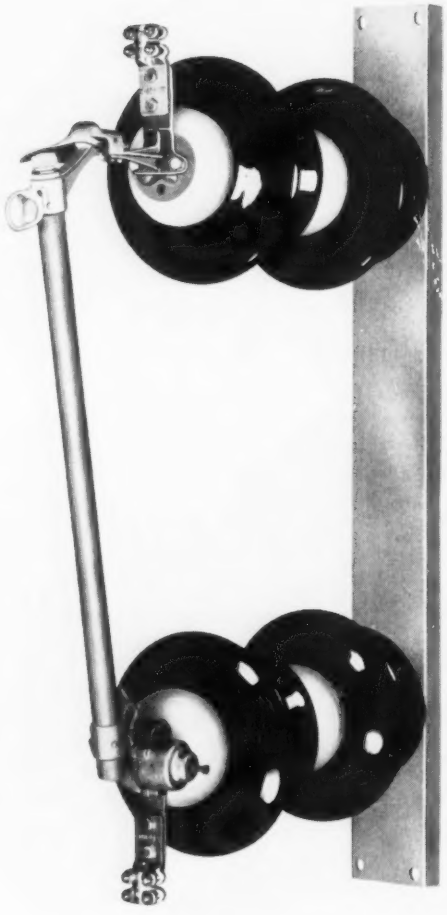
The complete story about the unusual operating characteristics of the Riley TURBO FURNACE and DIRECTIONAL FLAME BURNERS can be obtained by writing RILEY STOKER CORPORATION, WORCESTER, MASSACHUSETTS or contacting a Riley representative in any one of these cities:

Chicago, Cincinnati, Cleveland, Detroit, Houston, Jacksonville, Kansas City, Los Angeles, New Orleans, New York, Philadelphia, Pittsburgh, Portland, Salt Lake City, San Francisco, Seattle, St. Louis, St. Paul, Syracuse, Worcester.

RILEY

STEAM GENERATING & FUEL BURNING EQUIPMENT

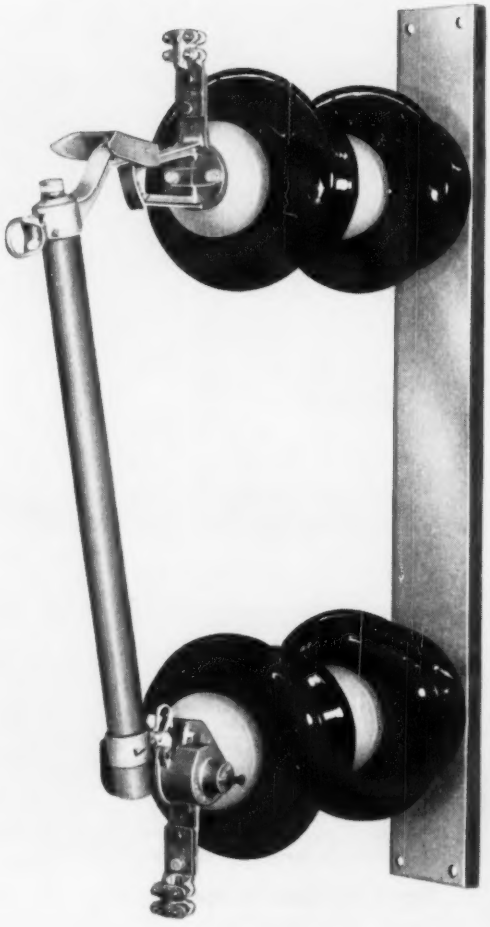
A Powerful New Family of



TYPE BP

7.5 kv to 69 kv—100 and 200 amps

This heavy duty power fuse is ideally suited for economical system protection when interrupting capacities range no higher than 1,491,000 kva.



TYPE MP

46 kv to 161 kv—100 and 200 amps

This extra heavy duty power fuse is the huskiest of the Southern States line, with interrupting ratings as high as 3,430,000 kva. A real brute!

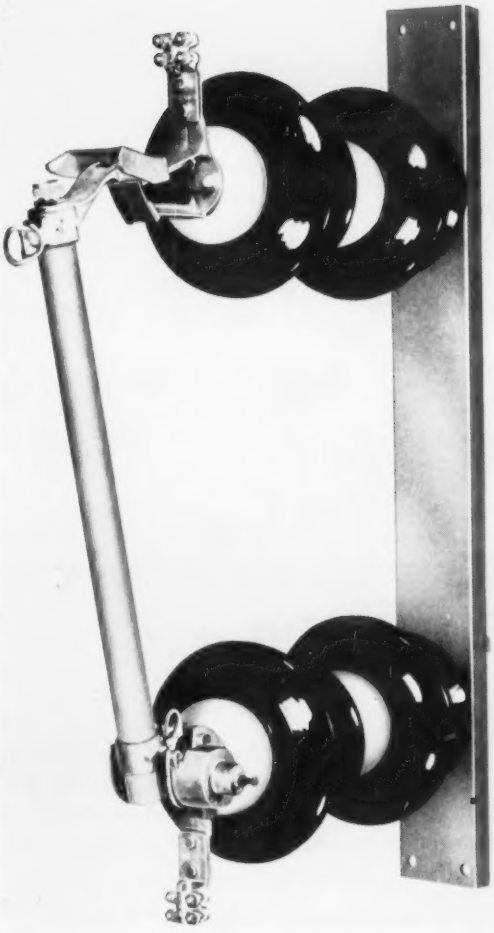
PIONEERS IN POWER FUSES SINCE 1924

SOUTHERN STATES EQUIPMENT CORP.

HAMPTON, GEORGIA

IN CANADA: Dominion Cutout Co., Ltd., Toronto

Power Fuses by Southern States



TYPE HP

7.5 kv to 69 kv—300 and 400 amps

This extra heavy duty fuse is especially suited for applications requiring a combination of high continuous current and interrupting ratings.

COMPLETE FUSE KITS AVAILABLE

These economical kits, in clearly marked packages, provide field personnel with *all the components necessary* for quick, easy re-fusing. They are available in four speed ratios to meet all requirements. Contents are sealed in moisture-free polyethylene bags.

• HIGHEST INTERRUPTING RATINGS

Up to 785,000 kva at 23 kv—
2,350,000 at 69 kv—3,480,000 at 161 kv

• LOWEST INITIAL AND RE-FUSING COSTS

• WIDEST RANGE OF SELECTIONS

Here is the greatest development in power fuses in years! It comes at a time when higher system faults and complex load conditions call for greater reliability in system protective devices.

Southern States Power Fuses can be used with full assurance of positive interruption in the complete range of fault currents—from the lowest that will melt the current-responsive element to the worst jolt the system can deliver!

The fuses employ a new fuse holder design and rugged fibreglass* fuse tubes to clear faults at values never before thought possible.

For example, look at these representative ratings:

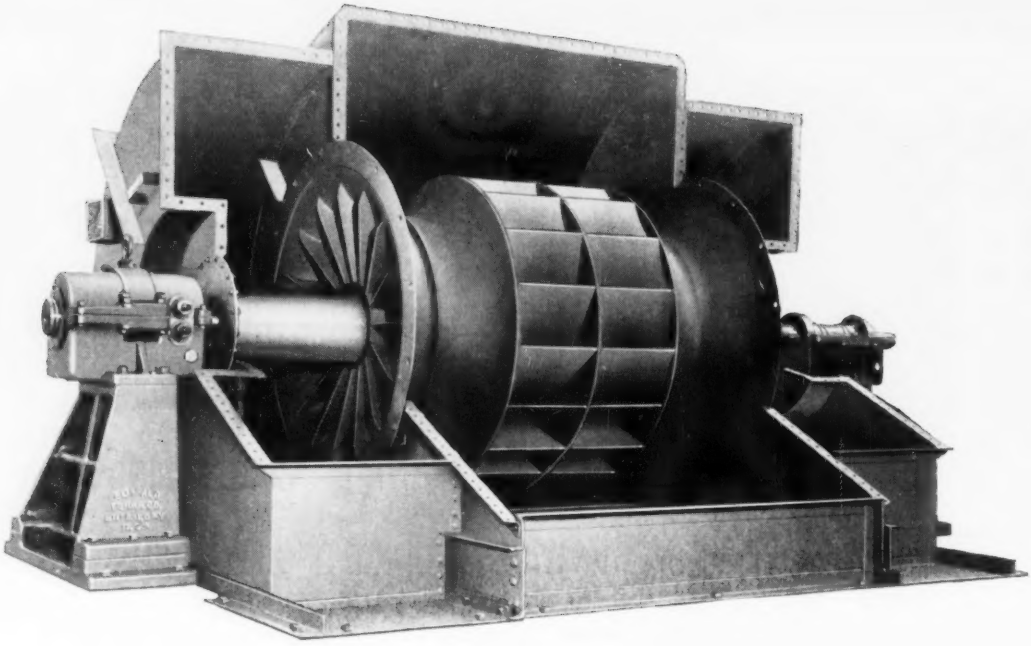
TYPE	KV	KVA 3 phase symmetrical
BP	7.5	162,000
BP	15	406,000
BP	23	785,000
BP	34.5	1,175,000
MP	46	1,988,000
MP	69	2,350,000
MP	115	3,110,000
MP	138	2,980,000
MP	161	3,480,000

Find out how these new Southern States Power Fuses can be used on your system—to provide greater protection at lower cost. See your Southern States representative, or

WRITE FOR NEW TECHNICAL BULLETIN 59PF

SOUTHERN STATES EQUIPMENT CORP.
HAMPTON, GEORGIA

**For economy and where duty requirements are not excessively high, fuse tubes of NEMA grade XX bakelite are available below 46 kv at lower prices.*



"Buffalo" Airfoils are Available in Capacities in Excess of One-Half Million CFM, Pressures to 80" Water.

"BUFFALO" AIRFOILS COST LESS TO OPERATE ...REQUIRE LESS MAINTENANCE

HERE'S WHY: If you are considering the use of airfoil fans for mechanical draft service, ponder these facts regarding the "Buffalo" Airfoil.

With a true peak mechanical efficiency of 92% and an extremely broad static efficiency curve, as compared to most competitive airfoil designs, the "Buffalo" Airfoil definitely costs less to operate. Major factors governing this efficiency are—a completely streamlined inlet with inlet bell and wheel flange forming a true half-circle—fixed or variable inlet vanes, where used, are placed well into the inlet throat to fully utilize horsepower reducing spin developed by the vanes—generous inlet boxes with external bracing give low entry loss—airfoil wheel incorporates proper blade passages for best air-flow through the wheel—scroll shape lets air stream from blade passages to housing channel with greatest ease—divergent outlet provides optimum static regain from cut-off.

This top efficiency, combined with the famous "Buffalo" "Q" Factor* Construction for a longer life with less maintenance, makes the "Buffalo" Airfoil best suited for this specialized service. For full details phone your Buffalo Engineering representative or write for Bulletin FD-905.

**The "Q" Factor — the built-in Quality which provides trouble-free satisfaction and long life.*

"Buffalo"

BUFFALO FORGE COMPANY
Buffalo, N. Y.

Buffalo Pumps Division Buffalo, N. Y.
Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

VENTILATING • AIR CLEANING • AIR TEMPERING • INDUCED DRAFT • EXHAUSTING • FORCED DRAFT • COOLING • HEATING • PRESSURE BLOWING

above was taken about 45 days after brush at the left was sprayed ammate" X. Note how it killed the brush without injuring the tobacco g adjacent to it. Since "Ammate" X is non-volatile, there are no from it to injure nearby sensitive crops.

"Ammate" X being applied on brush close to grapes on this distribution line of the Duquesne Light Co., Pittsburgh, Pa. Duquesne has used "Ammate" X in this type of spraying since 1947, without a single claim for damages due to spray fumes.

How to get long-term brush control thout crop injury: Spray with DuPont AMMATE® X

picture, "Ammate" X is being sprayed at the rate of 60 lbs. per 100 of water next to cotton by the J. I. Brown Tree Expert Co., South g, Tenn. Brown, who has used "Ammate" since 1948, says "we have his product to give superior kill without danger to adjacent crops."

Note how "Ammate" X killed brush next to cotton without injury to the crop. Brush under this Southern Pine Rural Electric Power Association right-of-way, Taylorsville, Miss. was sprayed in June and photograph was taken two months later.

Du Pont "Ammate" X assures lower-cost, longer-term brush control because when the original spray job is done well, only occasional spot sprays are required to keep brush under control for subsequent years. And, as illustrated above, "Ammate" X is the brush killer to use on rights-of-way that adjoin sensitive crops such as cotton, tobacco, tomatoes, soybeans, grapes, peanuts, since it presents no volatility hazards.

Around sub-stations, pole yards or wherever weeds and grass make maintenance difficult and costly, use "Telvar" monuron or "Karmex" diuron weed killer.

This season, try new "Dybar" fenuron weed and brush killer. "Dybar" kills brush through root action. It comes in pellet form, for easy spreading, even in hard-to-reach areas. Recommended for use East of the Rocky Mountains.

Du Pont weed control specialists are ready to help you choose the proper chemicals for an efficient and economical brush and weed control program. Write Du Pont, Grasselli Chemicals Department, D-4036, Wilmington 98, Delaware.

On all chemicals, always follow label instructions and warnings carefully.

DU PONT
REG. U.S. PAT. OFF.

Better Things for Better Living
. . . through Chemistry

Weed and Brush Killers

AMMATE® X	TELVAR®	KARMEX®	DYBAR
weed and brush killer	monuron weed killer	diuron weed killer	fenuron weed killer

Let Peabody help you select your new plant site

Be sure you are near the world's largest Coal Reserves for a low-cost, unlimited fuel supply

Since your fuel costs are governed to a large extent by transportation charges, it is *good business* to locate your new plant near a large, dependable reservoir of coal. PEABODY, with two billion tons of proven reserves, can help you select that site . . . where your burning equipment can be fed from one of PEABODY'S ultramodern mines and coal processing plants. Result: your assurance of an economical coal supply far into the future. Long-range planning is an important part of our business. May we be of service to YOU? *Get your free booklet, "This Is Peabody Coal Company", and learn more facts about PEABODY and its complete coal service. Write Department EW.*

power for progress

PEABODY COAL COMPANY

Peabody Plaza, 301 Olive Street, St. Louis 2, Missouri

GENERAL OFFICES: PEABODY PLAZA, ST. LOUIS. OFFICES IN: CHICAGO, DES MOINES, KANSAS CITY, LOUISVILLE, MEMPHIS, MINNEAPOLIS, NASHVILLE

The Electrical Week

FUTURE NEWS ▶ **Watch for increased coal-pipeline activity.** At least four utilities east of the Rockies are eyeing Cleveland Electric's installation.

LATE NEWS ▶ **Washington Wire** . . . The Administration is looking into a plan to use private money for electric co-op financing. The proposal, now being studied by the Budget Bureau, would handle the money through a federal revolving fund . . . Political and labor pressure is building up to curb imports of hydro and steam generators. Meanwhile, GE and Westinghouse ask for separate OCDM ruling on defense-essentiality of individual products . . . Sen Morse probably won't introduce his high Hells Canyon bill this year. Reason: withdrawal of support from other Pacific NW senators . . . FPC will hold oral argument Feb. 26 on evidence to be allowed in ECAP and Southwestern Electric cases.

Nuclear Notes . . . Capital cost aid for prototype A-plants is in the offing as AEC announces policy switch . . . McCone reveals Philadelphia gas-cooled reactor project has been "tentatively accepted" . . . AEC proceeds with construction of organic-moderated power reactor at Piqua, Ohio.

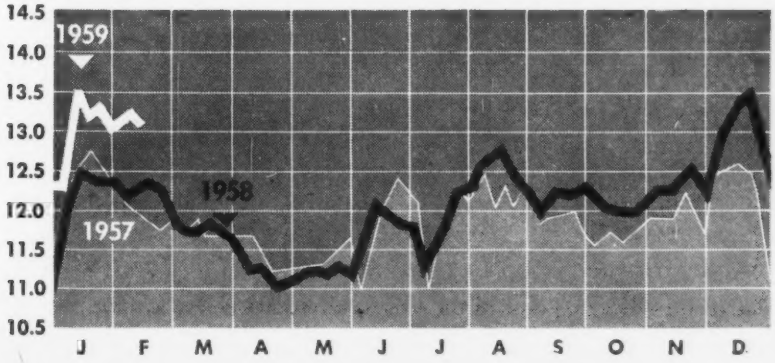
EEI's National Electric Living Program is now well under way, kicked off by three-page ads in Life and Saturday Evening Post during National Electrical Week. A big spring push is slated.

Westinghouse will unveil new Athens Ga., plant to stockholders at April 1st annual meeting.

Toledo Edison conducts utility economics course for 100 foremen. Idea is to acquaint foremen with factual information about the business, and to enable them to convey that to others.

Management changes . . . P. S. of Colorado appoints P. A. Yetter a vp . . . G. A. Schoenbucher becomes vp of New England Power Service Co . . . Allis-Chalmers elects B. E. Smith vp.

WEEKLY POWER OUTPUT—UP 6.0% (Week ending Feb. 14), Kwhr 13,156,000,000



Per Cent Change From Previous Year

	Jan. 31	Feb. 7	Feb. 14
Total U. S.	+ 7.5	+ 8.2	+ 6.0
New Eng.	+ 8.8	+ 8.4	+ 8.0
Mid. Atlantic	+ 7.7	+ 6.4	+ 4.5
Cent. Ind.	+10.2	+10.5	+ 7.1
West Cent.	+12.2	+12.0	+ 7.6
Southeast	+ 0.9	+ 2.1	− 2.1
South Cent.	+12.1	+12.3	+ 9.1
Rocky Mount.	+ 4.8	+14.2	+14.5
Pacific			
NW	+ 8.1	+10.8	+14.6
SW	+ 9.4	+10.6	+13.6

Seasonally Adjusted Index 248.2
Week Ago 250.0 Year Ago 234.2

Source: Edison Electric Institute

Preview of this Issue

EVENTS ▶ **Ike tells co-ops to stop seeking favored financial treatment** from U. S. Treasury. He predicted a hike in 2% interest rate, but Sens Johnson, Kennedy and Speaker Rayburn say Congress will do no such thing. This all happened at the annual meeting of the National Rural Electric Cooperative Assn in Washington, Feb. 9-12, a report on which begins on **p 76** . . . Storms, floods harass Midwest utilties **(p 78)** . . . Winning models in Syracuse University's electric car design competition may be a preview of things to come **(p 79)** . . . Co-ops, municipals hit Missouri Valley power allocations **(p 80).**

SPECIAL REPORT ▶ 55TH ANNUAL STATISTICAL REPORT PART II

Highlights of Part II of EW's 55th Annual Statistical Report (p 83): U. S. electric utilities plan to add 37,658 Mw of new capacity in the next three years, and are already planning another 23,237 Mw after 1961. Other highlights:

- **Energy sales (p 84)** jumped 2.1% in 1958. Breakdown: Residential—8.1% to 159 billion kwhr; Commercial—6.4% to 101 billion kwhr; Industrial—down 2.6% as a result of the recession.
- **Average residential use** hit 3,377 kwhr, up 203 for the year.
- **Revenues** jumped to $9.7 billion, up 4.8%.
- **Installed capacity** climbed to 142.4 million kw at year-end, but shipments of electrical equipment plummeted 10.1% to $19.5 billion.

Politics and Public Power

POWER IN THE STATE LEGISLATURES

A flood of power bills are hitting the state legislatures. Here's a rundown of important bills introduced in various states . . .

In the Northwest, an Oregon bill would reduce excise tax rate from 7% to 6%. Increased tax take would then come by having companies compute net income the same as other Oregon corporations, rather than by using federal income tax figures. Electric utility attitude is typified by Pacific P&L attorney Francis Hill: "If you're going to raise $2 million with this bill, most of it will come from companies with federal certificates of accelerated amortization, and that means only three companies—PG&E, PP&L, and California-Oregon Power." In another bill, Oregon PUD's would be able to issue and sell revenue bonds without the now-required popular vote. A **Wyoming** bill would place sales of interstate utilities to large industrial users under the state PSC. It provides that metered sales by a producer are not exempt from regulation by the commission. **In Washington,** a bill has been introduced that would establish two clases of PUD's: first class would contain districts with $10 million or more in net-plant value; second class to be made up of all others. First-class PUD's would have five-man commission instead of three. Another bill would allow the state attorney general to aid the county district attorney in grand jury probes. Other PUD legislation would permit short-term interim financing, clarify privilege tax on power, shorten the time for bid calls on materials, and allow a PUD to build lines outside its country. Watch for a legislative attempt to block Tacoma City Light's proposed Cowlitz River hydro project by the state Sportsman's Council.

MONEY MARKET OUTLOOK ▶ **What's ahead in the 1959 money markets?** This year about $1.7 billion in electric utility new money financing will run through a volatile and unpredictable money market. It looks like now is a good time to raise equity money, but bond issuers should play their cards close to the chest, with one eye cocked on the U. S. Treasury **(p 137).**

MANUFACTURERS ▶ **A mobile, combination autotransformer and single-phase transformer,** built by General Electric will serve 18 substations on Pacific Gas & Electric Co's system . . . Westinghouse has come up with a crate-less method for shipping transformers. The method, which uses pallets, is said to save customers $2.00 per unit in handling and storage costs. Damages are less than when wooden crates are used **(p 119).**

NEW EQUIPMENT ▶ **Meter socket with either one or two 1-kvar capacitors** is preassembled in standard duplex housing . . . 100-Kvar capacitors have cooling ducts in tank sidewalls and ends . . . Transformer hoist is redesigned for safety **(p 128).**

SELLING ▶ **Delaware P&L to relight entire street lighting system in Wilmington.** The new job spells a total increase in lumen output of 30%, while costs will be boosted only 18% **(p 145).**

In the Midwest: Missouri legislature has a bill which would direct the PSC to use depreciated original cost for utility rate-making purposes. Measure requires using only original cost less depreciation plus reasonable allowance for supplies, material, and capital. The **Nebraska** legislature got a bill which would prohibit PPD's from retailing appliances. **Indiana** co-ops have a bill in the hopper which will permit them to form joint G&T corporations with municipals. Rates would be set by new corporation's board, with no PSC regulation. Another bill would deprive PSC of authority over federal co-op loans.

In the South, Gov Hollings of **South Carolina** has asked the state legislature to remove the sales tax exemption from industrial coal, gas, and electricity sales, and also remove the electricity retail sales tax exemption. Hollings says this would bring $3,350,000 additional revenue. **West Virginia** legislature is being asked to give the PSC discretion to suspend proposed new utility rates an additional four months over the present 120-day period.

In the East, New York has the deluge of power legislation, including: A bill to revise the PSC; several bills to provide conjunctional billing at lowest rate for adjacent buildings under the same management; and a bill disallowing the PSC to OK rate changes without 30 days' notice. The Pennsylvania legislature has a bill providing for real estate taxes on utility properties. In **Delaware,** a bill would repeal that part of the law which permits a utility to put a rate increase tentatively into effect, under bond, while the PSC is studying the application. The bill would allow PSC to suspend rate increases up to six months, and to require the utility to furnish customers with evidence of the need for increased rates.

The primary problems facing businessmen increasingly have had their roots in areas involving relations with employees, unions, the federal government, and the general public. Businessmen should devote as much managerial attention to the overall climate for business as to technical, marketing, or financial matters.
J. S. Parker, General Electric Co, before the Chamber of Commerce, Dayton, Ohio.

Temporary 250-ton gantry saved almost $300,000 in construction costs at three hydro stations of Pacific Gas & Electric Co. The unit is assembled at each station to complement a 25-ton permanent gantry, which aids in the erection of the larger unit. **Electrical West, December, 1958.**

TECHNICAL NOTES

Forced cooling of short lengths of high-voltage ac cables allows a notable increase in transmission capacity. In one instance, 1,410 Mva was transmitted at 510 kv.

Progress in EHV circuit breaker design contributes to a reduction in amplitude of switching surges. The Russians take advantage of this progress by raising voltage to 500 kv without modifying the insulation; the Swedes hold to 420 kv but with a decrease in insulation.

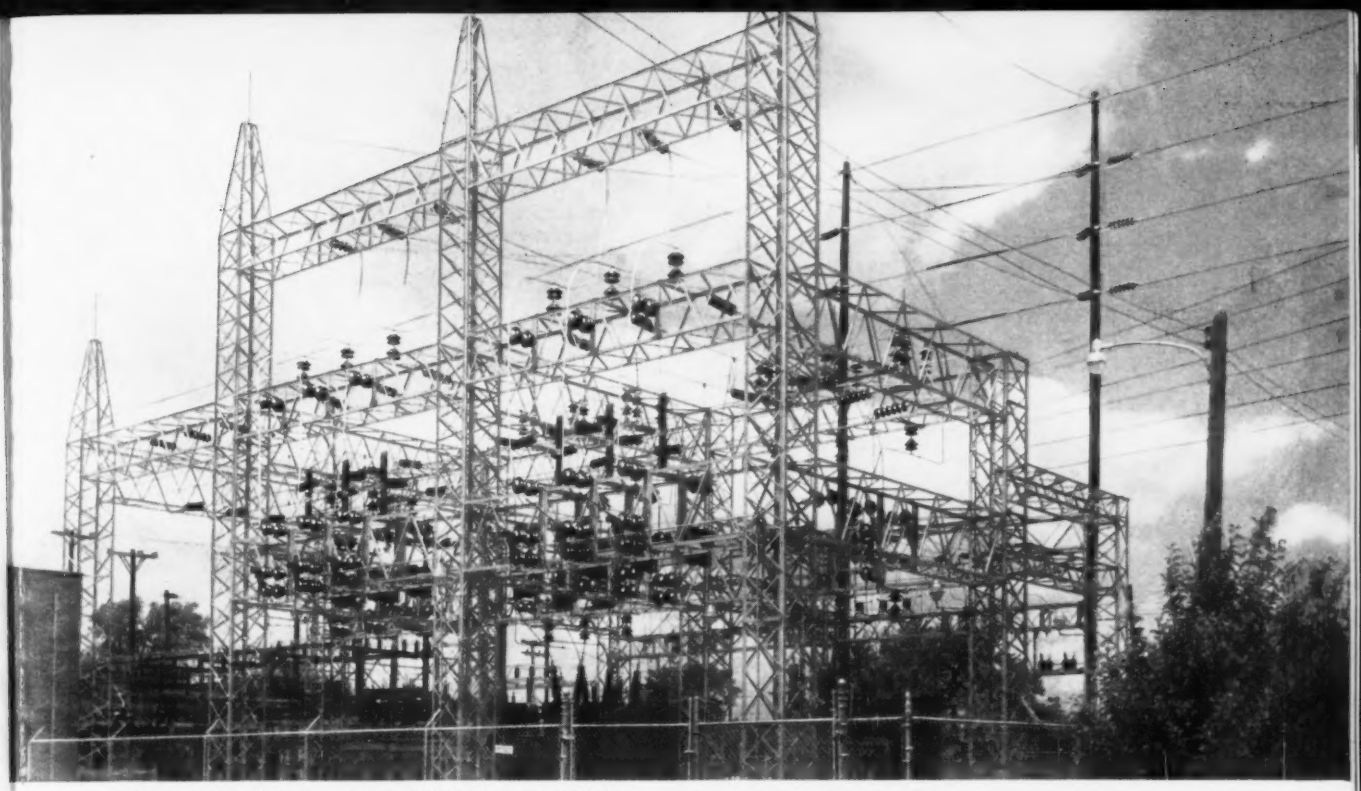
Cost of land averaged 2.07% of total cost in a study of 169 generating stations of various ratings built before 1948. Land for 95 stations of 100 Mw or more in the last decade cost 0.91% of the total. Long-term average is 1.68%, with an 11.5% maximum.

Holding strength of steel cellular cofferdams may be demonstrated through use of a soil-pressure gauge which reads the internal fill pressure.

FROM EDITORS IN THE FIELD

Economic dispatch is solved on a digital computer for 26 steam turbines and 54 boilers at three stations on the Boston Edison system. Solution includes transmission penalty factor. The computer also forecasts cost of interchange power for sale or purchase.

Losses from a 450-Mva underground substation will heat the new 24-story headquarters building of Quebec Hydro Electric Commission. Auxiliary heating will provide for unusually cold periods.



LARGE URBAN-TYPE L-M PACKAGED SUBSTATION, designed by Line Material and erected in minimum time with L-M prefabricated steel. Incoming lines are 69 kv; outgoing are 7.2/12.47 kv. L-M engineers design these packaged stations in sizes from 5 to 161 kv, for industrial plants, and for rural and urban locations on utility company lines—all with completely coordinated plans, structure, and equipment.

L-M-Engineered Packaged Substations Save Planning and Construction Time

by **W. V. SWAN,** Product Manager
Substations and Power Switching Equipment
Line Material Industries

Line Material packaged substations offer wide choice of design and application; considerable flexibility and provision for future expansion; great savings in engineering and ordering for utilities. And, because of L-M's unique prefabricated steel structure, these substations are fast and easy to erect.

One Order Does It!

Completely coordinated L-M substations need only one order; are delivered either as one shipment or coordinated to your construction schedule. It's easy to order an L-M substation. Just give us a one-line diagram of what you want—or tell us your voltage, kva requirements, number of incoming lines and outgoing feeders, and area available—and we'll design your substation for you!

Fast Erection

L-M's pre-engineered steel trusses and columns are completely prefabricated, and shipped knocked down or factory-assembled. Structures are steel, or aluminum alloy. Members have round holes punched at 3-inch intervals (before galvanizing) with square holes every foot. This eliminates measuring and drilling, and damage to galvanizing. Holes accommodate all bolts for lacing members and apparatus. That's why they go up so fast.

Prompt Shipment

Structural steel can be shipped in 3 to 4 weeks after final approval of order; complete stations in 4 to 12 weeks. Station design provides for easy, safe accessibility to all equipment. Stations meet NEMA, ASA and AIEE standards.

Ask the L-M Field Engineer for complete information and bulletins; or write Line Material Industries, Substation Department, Milwaukee 1, Wisconsin.

LINE MATERIAL Industries
McGRAW-EDISON COMPANY

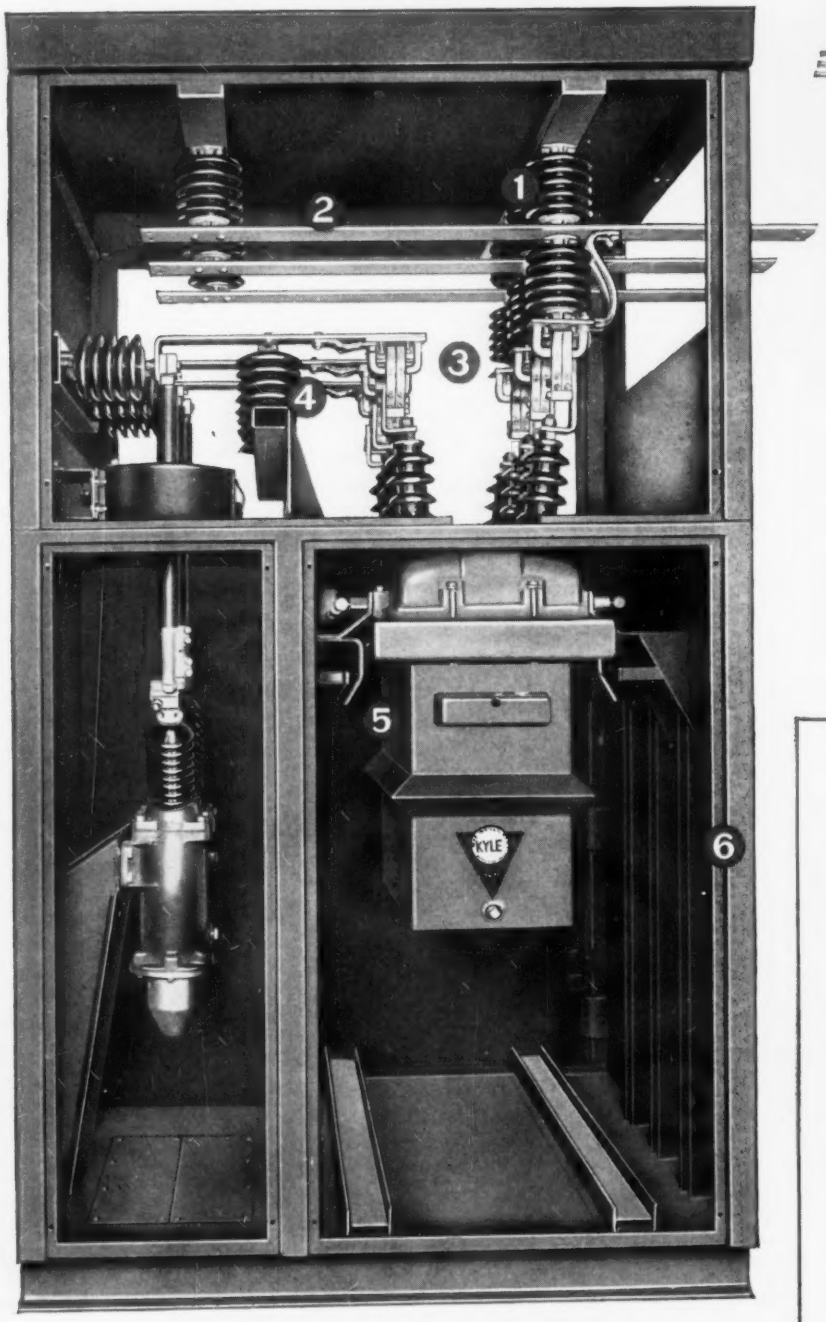
382

Packaged Substations

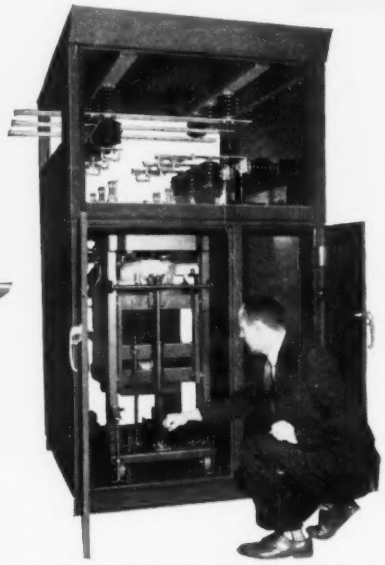
McGRAW EDISON

DISTRIBUTION TRANSFORMERS • KYLE RECLOSERS AND OIL SWITCHES • FUSE CUTOUTS AND FUSE LINKS • LIGHTNING ARRESTERS • POWER SWITCHING EQUIPMENT
PACKAGED SUBSTATIONS • CAPACITORS • REGULATORS • OUTDOOR LIGHTING • LINE CONSTRUCTION MATERIALS • PORCELAIN INSULATORS • FIBRE PIPE AND CONDUIT

1. Porcelain bushings—which, with air insulation, give high impulse and corona levels, and greater permanent creepage strength than phenolic insulation.
2. High location of main bus permits normal operation in flood areas. Units can operate in over 2 feet of water without damage or service interruption.
3. Recloser primary and secondary connections are automatically made as recloser is raised into operating position. Bushings on recloser have special flexible self-aligning disconnects.
4. One of a number of troughs provided for low-voltage wiring.
5. Type W Recloser. Type R may also be used where loads are smaller, and changed to Type W when situation necessitates.
6. Compact—takes from 10 to 25% less ground area (and a smaller pad), and 25 to 35% less volume than comparable metal-clad equipment.



REAR VIEW of feeder unit with all panels removed.



HYDRAULIC LIFT TRUCK. Recloser is easily removed, or inserted and locked into operating position. Mechanical interlocks make it impossible to insert recloser into primary contacts unless recloser is in OPEN position.

Let's Clear Up "Clearing Time"

The published time-current characteristics for Kyle oil circuit reclosers include the *total* time, from instant of fault initiation to the completion of arc extinction. This includes the complete fault sensing period, tripping time, and sufficient contact travel time for complete interruption.

Since the fault sensing and timing means is incorporated within the Kyle recloser, this recloser is independent of external devices, which themselves may add appreciable time to the operating time claimed for other devices.

Thus the 2 or 2½ cycles in which Kyle reclosers clear faults is appreciably less time than that required by devices usually incorporated in metal-clad equipment. Therefore, Kyle switchgear gives much better protection to conductors, and much better insurance of service continuity.

THE NEW KYLE-KLAD SWITCHGEAR is designed so that the basic unit is simple, functional, and extremely economical, offering substantial savings over traditional metal-clad. But the design also makes possible a wide choice of variations, optional arrangements, and accessories to suit almost any requirements.

Kyle-Klad Metal-Enclosed Reclosers Offer Many Outstanding Features

Faster Clearing...Better Coordination...Lower Cost ...Porcelain-and-Air Major Insulation...Space Savings ...Provision for Future System Planning

FRANK McSTAY demonstrates accessibility of the meter compartment. The attractive low-line appearance of the Kyle enclosure makes it very desirable for urban areas. The unit is completely weatherized with phosphatized treatment, primer, and two coats of alkyd resin paint. Ventilators allow circulation of filtered air. Heaters prevent condensation of moisture.

by **FRANK W. McSTAY**, Product Manager
Kyle Switchgear, Line Material Industries

All of the well-known advantages of the Kyle Type W or Type R reclosers, plus simple, functional design, are now available in the new L-M Kyle-Klad metal-enclosed switchgear.

Cost As Low As $4,540

The units are simple and compact. They are highly efficient, and provide many advantages, at a substantially lower cost than that of the traditional metal-clad units. For example, the basic 15 kv 110 BIL feeder unit costs only $4,540.

Fastest Clearing Time

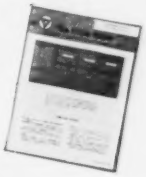
The reclosers themselves provide the fastest clearing, from fault initiation to arc extinction, of any device on the market. This high-speed clearing gives better protection to conductors against burndown and annealing, and thus assures better service continuity. Timing of the recloser is accomplished by self-contained time delay mechanisms which have indexed settings for specific time current characteristics. Kyle's usual wide choice of time current characteristics is available.

The units are quite flexible in many respects. There is a wide choice of optional equipment. Future expansion is easily handled, by either changing reclosers or adding additional feeder units. Space is provided in the auxiliary compartment for lightning protection. Many other features and options are available.

The units are compact, and installation is simple. They require less pad area, and therefore, less concrete. Fewer manhours are required for installation, offering additional savings. Thus Kyle-Klad equipment offers savings you cannot afford to ignore.

Get This Bulletin and Details From The L-M Field Engineer

Or write Mr. McStay at Kyle Products Division, Line Material Industries, Milwaukee 1, Wisconsin. In Canada: Canadian Line Materials, Ltd., Toronto 13, Ontario.



LINE MATERIAL Industries

McGRAW-EDISON COMPANY

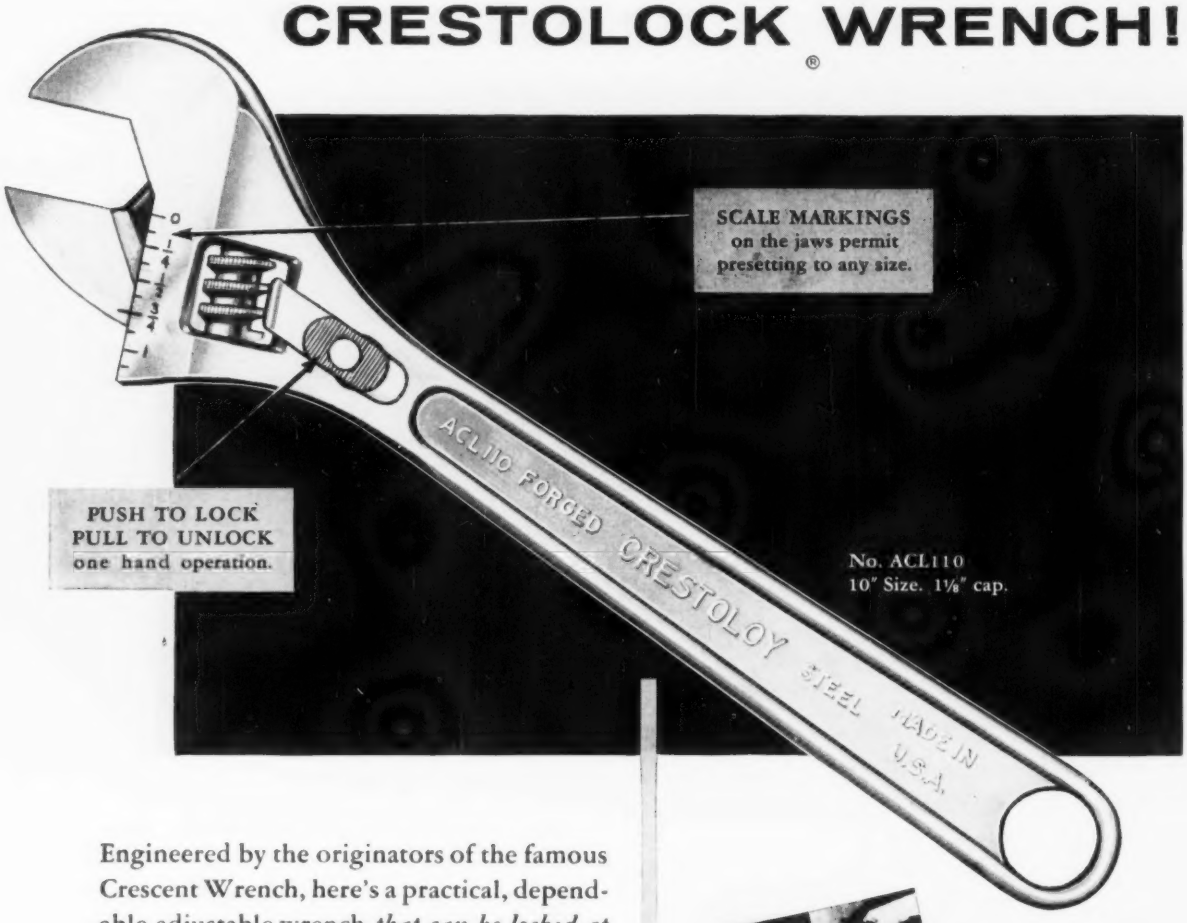
Kyle® Switchgear

McGRAW EDISON

358

DISTRIBUTION TRANSFORMERS • KYLE RECLOSERS AND OIL SWITCHES • FUSE CUTOUTS AND FUSE LINKS • LIGHTNING ARRESTERS
POWER SWITCHING EQUIPMENT • PACKAGED SUBSTATIONS • CAPACITORS • REGULATORS • OUTDOOR LIGHTING
LINE CONSTRUCTION MATERIALS • PORCELAIN INSULATORS • FIBRE PIPE AND CONDUIT

No other locking adjustable like this new
CRESTOLOCK® WRENCH!



Engineered by the originators of the famous Crescent Wrench, here's a practical, dependable adjustable wrench *that can be locked at any infinite opening size within its capacity.* Basically, it's the time-proven Crestoloy Wrench PLUS a simple, positive locking device.

There is no working strain on the lock . . . no projections . . . it is operated by the thumb of the same hand that holds the wrench. If the lock should be damaged, the wrench is still operative as a standard Crestoloy. Available in 8, 10 and 12 inch sizes, chrome plated with stainless steel locking device.

GET YOUR COPY Forty pages, profusely illustrated. Tells how to do it easier and better with 30 different hand tools. Tips on care and maintenance. Send a dime or get a copy FREE with the purchase of any Crescent Tool.

Crescent is our trade-mark, registered in the United States and abroad, for wrenches and other tools. Sold by leading distributors and retailers everywhere and made only by

CRESCENT TOOL COMPANY, JAMESTOWN, NEW YORK

TEST REACTOR LICENSE NO. 1 has been awarded to the General Electric Test Reactor (GETR), which went critical in December, 1958, and is now available for a variety of experimental programs. The nation's first large privately financed materials-testing reactor, the GETR combines the best testing features of tank and open-pool reactor types.

GETR: Industry's Newest Advance Toward Economic Nuclear Power

General Electric Test Reactor Provides Flexible New Facility For Accelerated Nuclear Research

The 30,000 kilowatt (thermal) GETR now offers to industry one of the widest ranges of nuclear testing capabilities available anywhere, and represents another significant tool in private industry's efforts toward the realization of economical nuclear power.

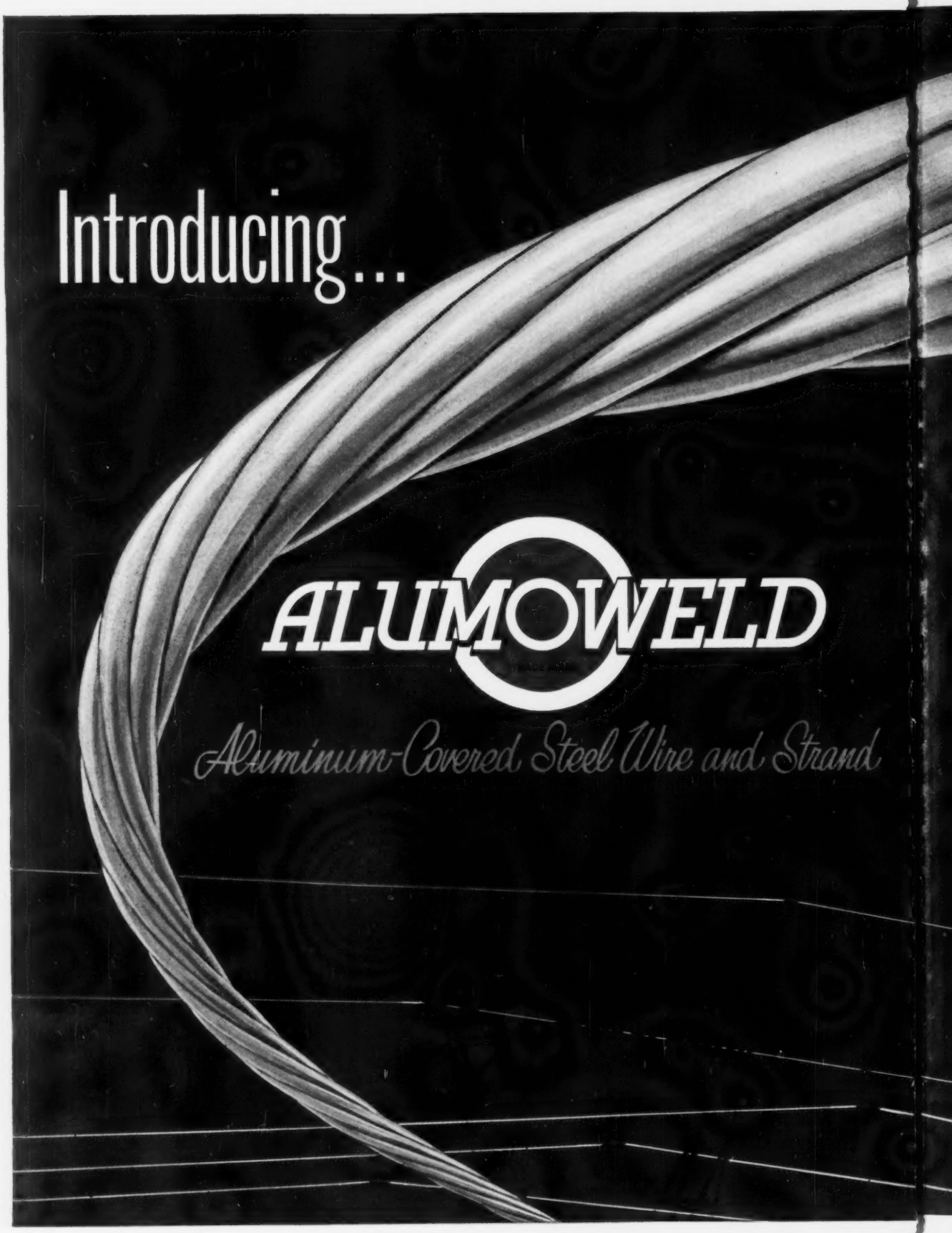
The new $4,000,000 reactor is located at the multimillion dollar General Electric Vallecitos Atomic Laboratory, where facilities also are available for post-irradiation examinations at the Radioactive Materials Laboratory, as well as for basic and applied research in nuclear physics, chemistry, and metallurgy.

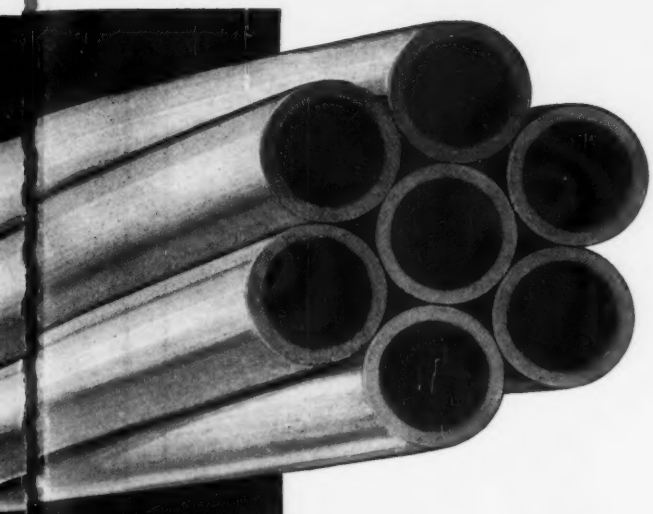
The unique design of the GETR provides both in-pile facilities for high neutron flux studies, and extensive pool facilities for a wide variety of other irradiation experiments. Capabilities include accelerated engineering tests on reactor fuels and components, general industrial materials-testing, and isotope production.

GETR capabilities accelerate research programs and speed solutions for fuel and material problems, pointing toward the day of economic nuclear power. Irradiation space is available. For information, write to: Manager—Sales, Section 191-3A, Atomic Power Equipment Department, General Electric Co., San Jose, California.

Atomic Power Equipment Department

GENERAL ELECTRIC


Introducing...
ALUMOWELD
Aluminum-Covered Steel Wire and Strand



for • overhead ground wire
• guy and messenger strand
• ACSR core wire

Exclusive features—

a **thick cladding** of aluminum
a controlled **atomic weld**

Since 1915, Copperweld has pioneered the development and manufacture of bimetallic wire. Out of this accumulation of metallurgical and production experience has come Alumoweld—the only aluminum-covered steel wire with a thick layer of pure aluminum. It is also the only aluminum-covered steel wire clad by the controlled atomic weld—a completely new technique which assures a ductile and permanent weld between the two metals under all operating conditions.

The mechanical and electrical characteristics of Alumoweld make it ideal for overhead ground wire as well as for guy and messenger strand. Its thick aluminum covering—25% by area—protects the high-strength steel core against corrosion. Compared to solid aluminum wire, Alumoweld has equal life, one third the conductivity, and eight times the strength. In fact, Alumoweld has the strength of steel wire, but in addition, it has much higher conductance, and will last longer.

Another excellent application for Alumoweld is core wire for ACSR conductors. Here, Alumoweld provides the same strength as existing core wires—eliminates dissimilar metals—adds conductivity in the strength wires. And because it is corrosion-resistant, Alumoweld gives you a high-strength core wire that matches the long life of the solid aluminum wires.

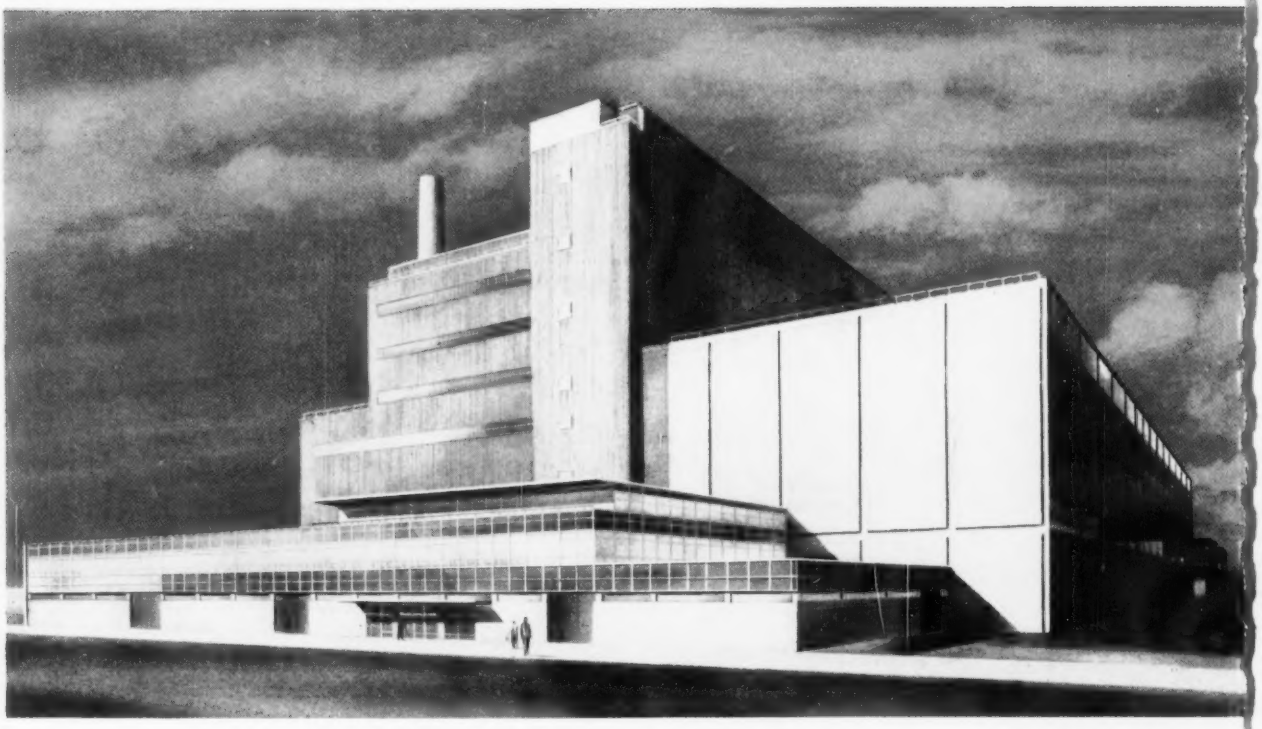
For more information about Alumoweld, write us direct or contact your nearest Copperweld field representative.

When ordering ACSR from your supplier make sure of the utmost in permanency and strength by specifying Alumoweld Core Wire (ACSR/AW).

PRODUCT OF COPPERWELD STEEL COMPANY, WIRE AND CABLE DIVISION, GLASSPORT, PA.

For Export: COPPERWELD STEEL INTERNATIONAL COMPANY, New York

Power Station



High point of steam power progress in 1959

Now nearing completion, and scheduled for service this year, is the Eddystone Plant of Philadelphia Electric Company, which is expected to establish new standards of steam power efficiency. The initial boiler is a C-E Sulzer Monotube Steam Generator, designed to deliver steam at 5000 psi throttle pressure and 1200 F — the highest steam conditions adopted to date. It will serve a 325,000-kw turbine-generator.

COMBUSTION

Combustion Engineering Building

ALL TYPES OF STEAM GENERATING, FUEL BURNING AND RELATED EQUIPMENT; NUCLEAR REACTORS;

trends revealed

by C-E Boilers placed in service in 1958

A significant milestone in electric utility history was reached last year when privately-owned generating capacity passed *100,000,000* kilowatts. This happened on May 11 when the C-E-powered, 75,000-kw unit at Station No. 4, Tucson Gas, Electric Light and Power Company, went on the line.

Last year also witnessed important progress in the economy of power generation as reflected in the trends toward higher steam pressures and unit capacities. These trends are impressively revealed by the following data of C-E Boiler installations – representing a total capacity of more than 5,000,000 kw – placed in service in 1958.

TREND TO 2400 PSI

The growing trend to 2400 psi throttle pressure was highlighted by the fact that 9 C-E Boilers in this pressure range went on the line during the year. These units alone account for *1,424,000 kw*. All but two of them are of the controlled circulation design; the two exceptions are C-E Sulzer Monotube Steam Generators.

TREND TO BIG UNITS

The previously-indicated trend to really big units began to make itself felt. Two of the C-E Boilers installed in 1958 serve turbine-generators of 325,000-kw capacity, and four additional units for this capacity are on order. Also on order are two larger units – one for 340,000 kw and one for 500,000 kw. Two of the six 325,000-kw units are C-E Sulzer Boilers for *supercritical* pressures.

CONTINUING TREND TO CONTROLLED CIRCULATION

Controlled Circulation continues to enjoy widespread acceptance for high-pressure utility boilers... particularly those in the 2400-psi range. 110 C-E Controlled Circulation Boilers have thus far been purchased by domestic utilities to serve an aggregate turbine capacity of 19,752,000 kw. Of these, 67 are now in service – with a total capacity of nearly 11-million kw. An additional 23 units, with total capacity of 5,030,750 kw, have been ordered from C-E, its associates or licensees, for installations outside the United States.

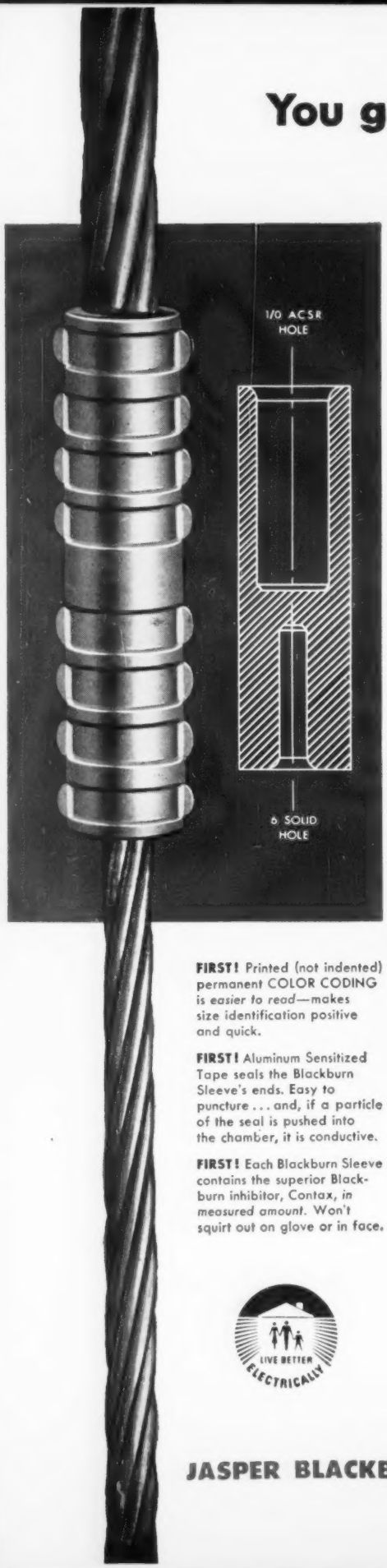
ENGINEERING

C-199

200 Madison Avenue, New York 16, N. Y.

PAPER MILL EQUIPMENT; PULVERIZERS; FLASH DRYING SYSTEMS; PRESSURE VESSELS; SOIL PIPE

You get HIGHER CONDUCTIVITY with BLACKBURN SERVICE ENTRANCE SLEEVES



because Blackburn... and Blackburn alone... provides GREATER CONTACT AREA where needed

Hole Depth Increases With Size of Conductor... thereby providing more contact area for the conductors being connected.

COLOR CODE	WIRE SIZE ACSR	WIRE SIZE AWG	HOLE DEPTH IN INCHES
Brown	–	8 sol — 10 str	.820
Green	–	6 sol — 8 str	.840
Blue	6	4 sol — 6 str	.860
Orange	4	2 sol — 4 str	.925
Red	2	1 sol — 2 str	1.010
Yellow	1/o	1/o str	1.185

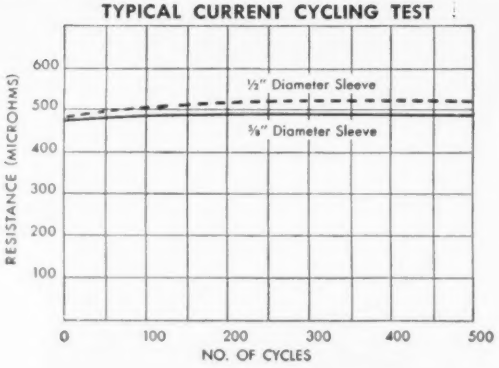
The center stop in a Blackburn Sleeve is a solid barrier that assures proper distribution of the inhibitor around the conductors.

FIRST! Printed (not indented) permanent COLOR CODING is *easier to read*—makes size identification positive and quick.

FIRST! Aluminum Sensitized Tape seals the Blackburn Sleeve's ends. Easy to puncture... and, if a particle of the seal is pushed into the chamber, it is conductive.

FIRST! Each Blackburn Sleeve contains the superior Blackburn inhibitor, Contax, *in measured amount.* Won't squirt out on glove or in face.

Conductivity of Connection PROVED GREATER Than Equivalent Length of The Conductors Being Connected.



A series of typical current cycling tests were conducted with both ½" x ⅜" diameter BLACKBURN Sleeves. Note the lower resistance of Blackburn Sleeves as compared to the equivalent length of cable without any sleeve.

Test Conditions

Wire: 2 ACSR to 4 stranded copper
Current: 190 Amperes
Cycle: 2 Hrs. "On" 1 Hr. "Off"
Length of Connection: 24 inches
Curves represent an average of five tests
Resistance of equivalent length of wire: 527 Microhms

LIVE BETTER ELECTRICALLY

JASPER BLACKBURN CORPORATION, 1525 Woodson Rd., St. Louis 14, Mo. • WYdown 3-9430

NEW

JOINS 26% FASTER

Because there are no separate couplings to assemble on the job, Orangeburg's new CA Conduit lays faster—costs less to install. In addition, there are no coupling cartons to handle, transport or store.

Orangeburg's new CA Conduit comes, at *no extra cost*, with a factory-attached coupling at one end and a standard 2° male taper at the other end. To join—CA's long, lightweight lengths are placed end to end—hammered home in a simple, one-step operation. Actual installations *prove* Orangeburg's new CA Conduit joins up to 26% faster!

What's more, because the attached coupling is *flush* with the outside diameter of the conduit, new CA Conduit is easy to handle and store in neat, even stacks. And with the new flush coupling there's no need to "stagger" conduit joints in the trench. That means less cutting and tooling time.

New CA Conduit—like the millions of feet of Orangeburg Fibre Conduit in use since 1893—has self-sealing joints and impermeable walls that make it absolutely watertight. Its smooth 100% fibre raceway adds years to cable life.

Specify new CA Conduit on your next job. This addition to Orangeburg's line is available in 2", 3", 4", 4½" and 5" sizes. Orangeburg's Standard and Nocrete Conduit with separate sleeve couplings are available as always. Orangeburg Manufacturing Co., Orangeburg, N. Y. and Newark, Calif.

ORANGEBURG MANUFACTURING CO.
A Division of The Flintkote Company, Manufacturers of America's Broadest Line of Building Products

Orangeburg Fibre Conduit is distributed by Graybar Electric Co. and General Electric Supply Co. with branches and stocks in principal cities.

B&W Pulverizer Design Simplicity Cuts Maintenance

A Compact, Space-Saving Package of Efficient Grinding Power

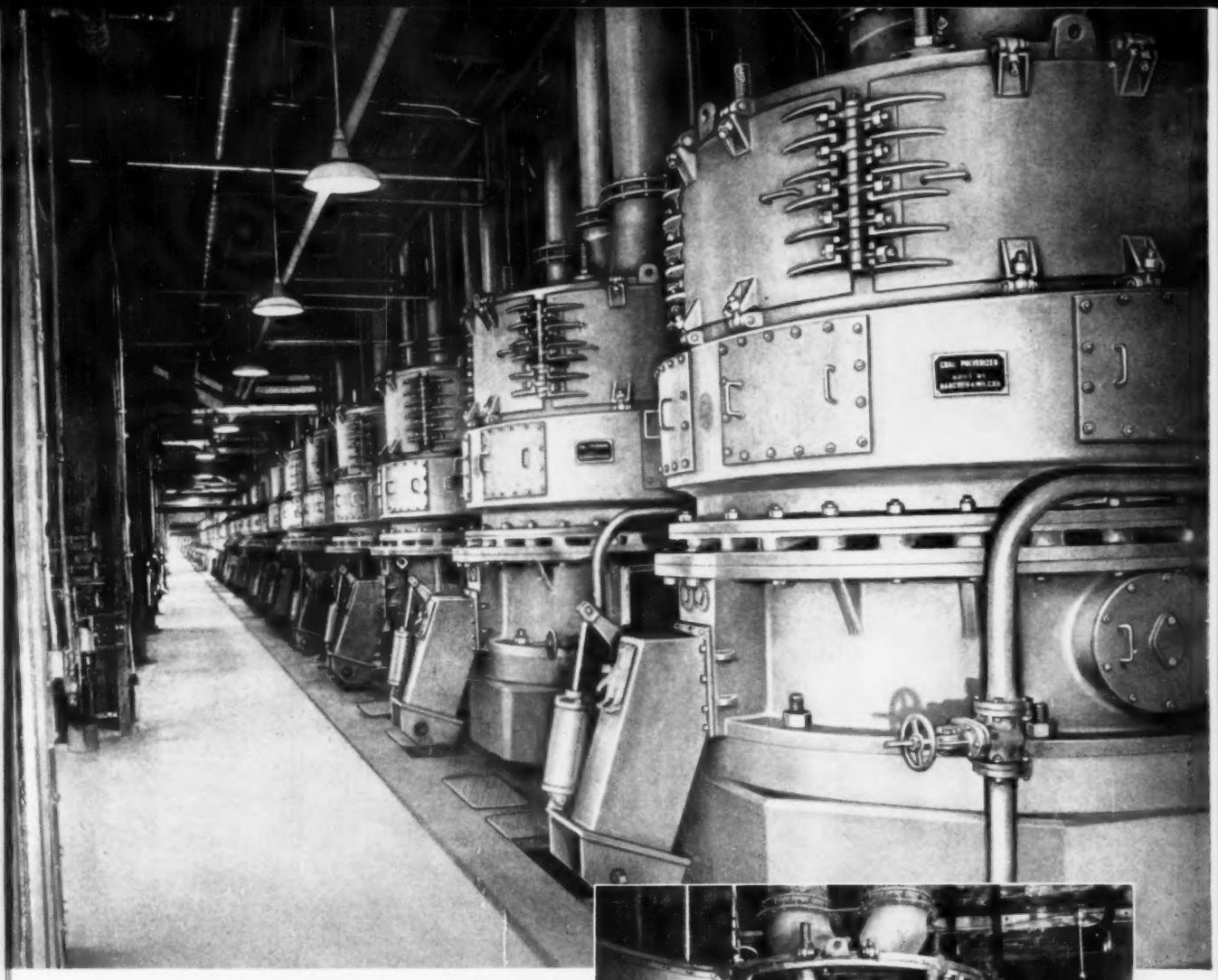
Exceptional output and efficiency records . . . highlighted by low maintenance . . . have been established in hundreds of installations by B&W Pulverizers. Their long-range dependability has been accompanied by reduced operating costs.

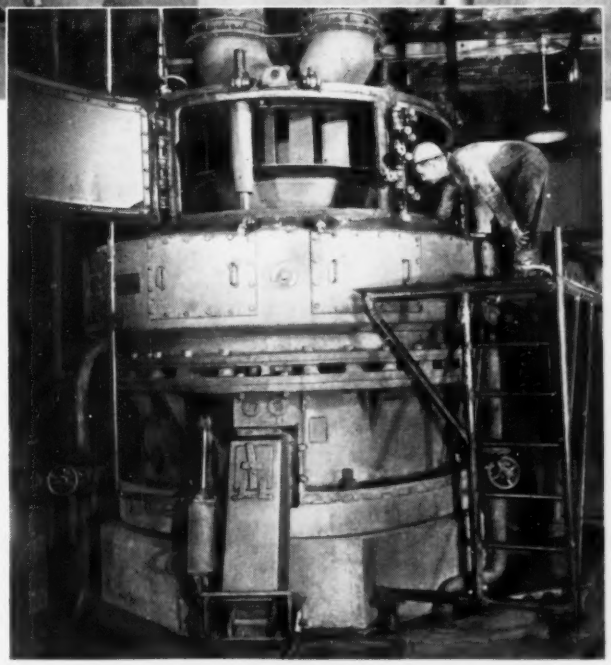
Simplicity of Arrangement and Reduced Maintenance: Accessibility for all normal maintenance makes it simple, quick, safe, and low-cost. Adjustments are easily made while the unit is in operation. Using only clean primary air supplied under pressure, fan maintenance is substantially reduced and fuel piping is greatly simplified. Also, with the pulverizer acting as its own distributor, no special distributing devices are needed. Grinding elements are of special alloy material. They last two years or more on eastern coals and at least a year on midwestern coals.

Continuous High Fineness Over Entire Service Life: Efficient combustion requires high fineness at all times. The high circulating load of the B&W Pulverizer permits efficient and dependable classification of product, so that only material of proper fineness leaves the unit. In addition, its slow-speed, spring-loaded ball bearing grinding elements maintain proper grinding contact throughout their service life.

Handles Wide Variety of Low Grade and Wet Coal: Regardless of the coal's grade or whether it's dry or soaking wet, the B&W Pulverizer's unique and exclusive recirculation of fuel through heated air assures efficient grinding . . . eliminates shutdown, capacity loss, or special attention from operators.

Adaptable to All Types of Automatic Controls: Because it features "one point contact with the





(Above) Part of the 42 B&W Pulverizers serving six B&W Open-Pass Boilers. (Right) Maintenance is simple: doors open wide, classifier and spring assemblies are readily accessible for removal. Grinding components are lifted without special rigging.

iler," operation of the B&W Pulverizer is simple. he boiler's automatic combustion control is con- ected to the pulverizer at only one point—the mper in the primary-air duct. The pulverizer's n control system regulates all other functions, ch as maintenance of proper fuel-air ratio and erating temperature.

ND FOR DATA. For full information about the &W Pulverizer and Pulverized-Fuel Firing Systems, rite: The Babcock & Wilcox Company, Boiler ivision, Barberton, Ohio.

B&W

THE BABCOCK & WILCOX COMPANY

BOILER DIVISION

924

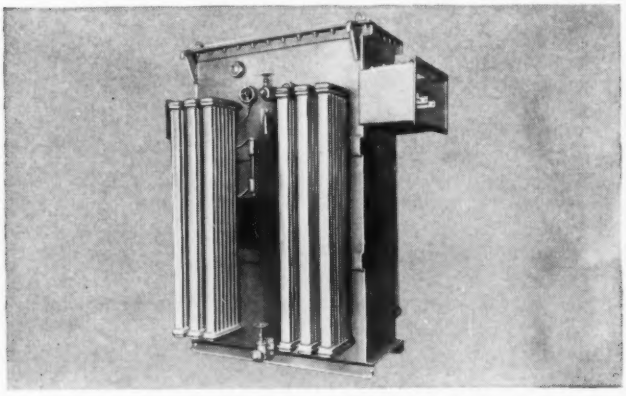
I-T-E CIRCUIT BREAKER COMPANY

COORDINATED

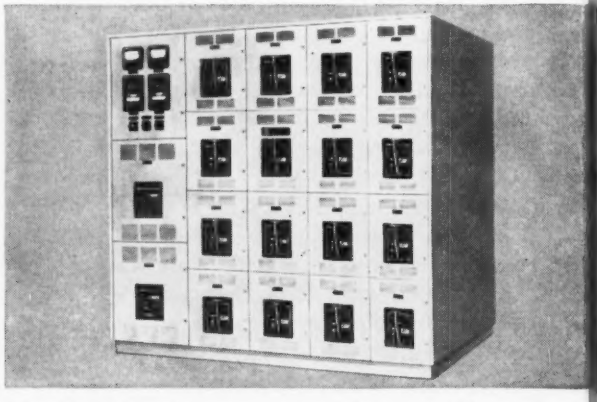
Only I-T-E designs and builds complete primary unit substations in one plant. And because engineers can work so closely together, you benefit from extra time-and-money saving features: better-coordinated designs, easier assembly, pretested performance, and delivery to match your own construction schedule.

At no extra cost to you, I-T-E can custom design and build substations to meet your own particular requirements. In every case you get the additional advantages of I-T-E switchgear . . . sturdier, safer and easier to operate. And I-T-E high-stress transformers incorporate extra protection from fault damage. I-T-E substations are available in all kva ratings and secondary voltages up to 13.8 kv., for indoor or outdoor installation.

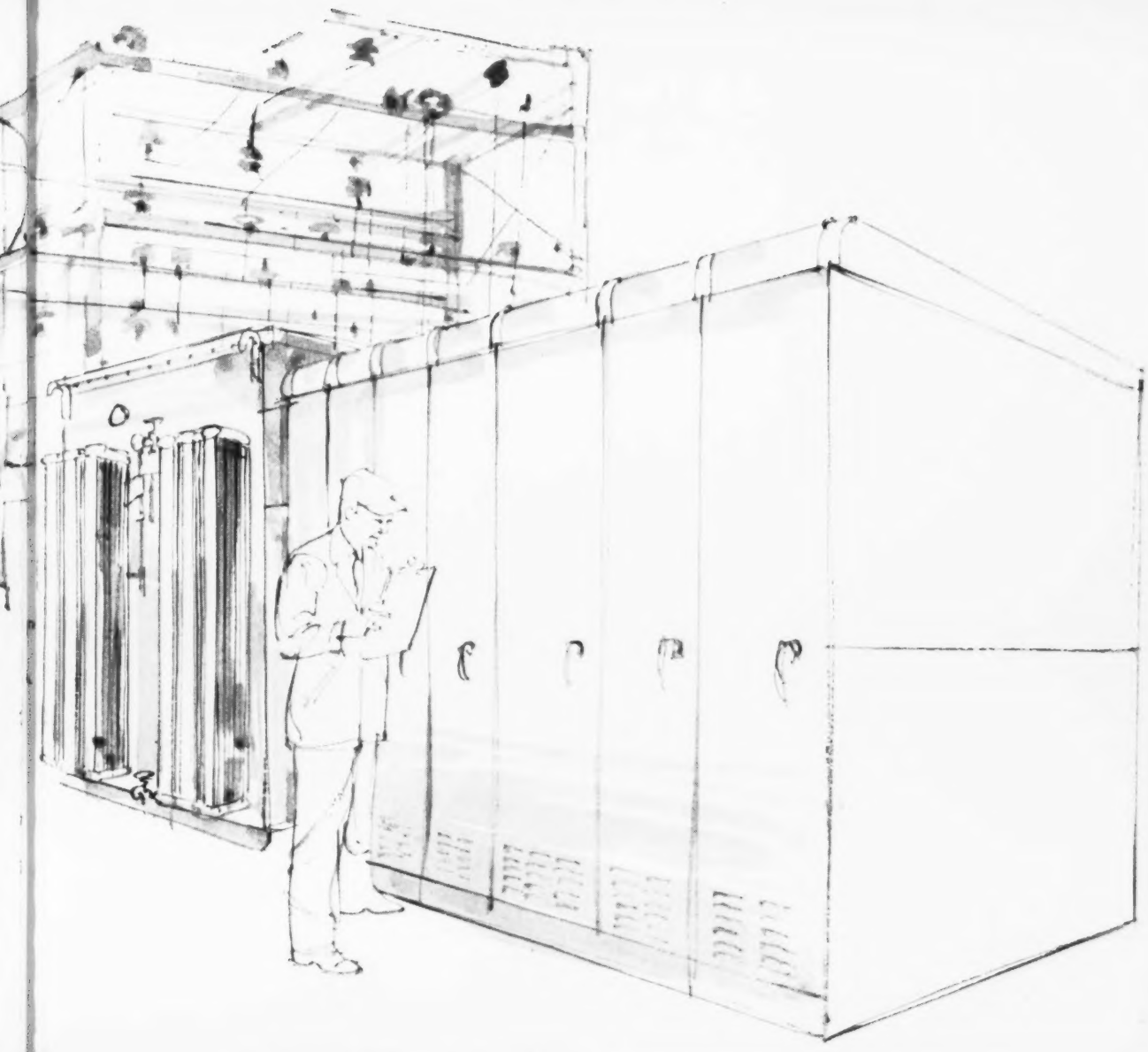
Today more and more electric utility companies are looking to I-T-E as their single source of supply for complete unit substations. For in I-T-E substations, too, they find the advanced design and quality construction to which they are accustomed in I-T-E electrical equipment. Equally important, I-T-E costs no more.

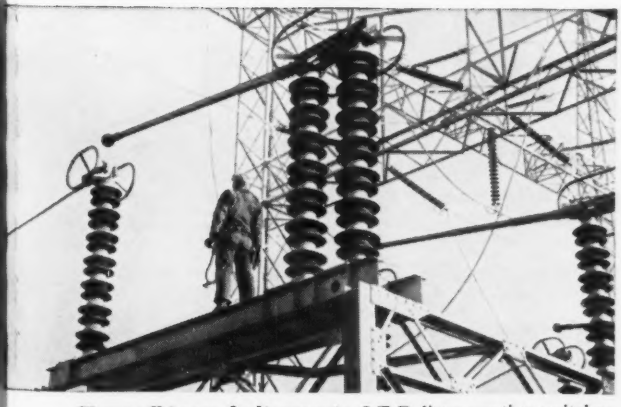


New designs, stronger construction. I-T-E substation transformers are available liquid-immersed or with ventilated dry type or sealed dry type construction. Ratings: liquid—112½ to 10,000 kva, up to 69 kv; dry ventilated—112½ to 3000 kva, up to 13.8 kv; dry sealed—300 to 3000 kva, up to 13.8 kv.



Manual quick-make means greater safety, extended contact life for I-T-E K-Line low-voltage switchgear. Expanded overcurrent trip provides maximum load flexibility. For added safety and convenience, K-Line circuit breakers can be moved to the test position or be disconnected with door closed.





Shrug off heavy fault currents. I-T-E disconnecting switches use heavy silver-to-copper jaw contacts with high thermal capacities to withstand heavy fault currents. Operate easily under severe icing. Available in vertical or horizontal break or tilting insulator configurations.

I-T-E Circuit Breaker Company
1900 Hamilton St., Philadelphia 30, Pa.

Send me detailed information on the following:

- ☐ Primary unit substations
- ☐ Unit substation transformers
- ☐ LV power switchgear (600 v)
- ☐ Outdoor air switches
- ☐ Load interrupter switches
- ☐ Outdoor substation structures
- ☐ Reclosers
- ☐ Distribution cutouts
- ☐ Other_____

Name_____ Title_____

Company_____

Address_____

City_____ Zone_____ State_____

SEND COUPON Get full particulars on specific I-T-E equipment. And remember I-T-E engineering assistance is at your disposal.

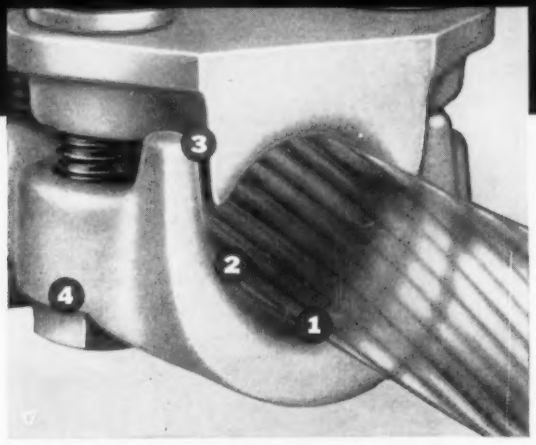
RANGE-TAKING TERMINAL

8 sizes install #8 thru 2000 MCM Aluminum or 1780 ACSR

Type NAR-A

Whether you are responsible for specifying, purchasing, inventory control or bossing a construction crew, the NAR-A line of range taking terminals is a line that can really do a job for you. It's a "clean", rugged, range-taking terminal that maintains a top performance record —up-and-down the cable ranges... up to 35 different cable sizes per connector.

The NAR-A does away with the old need of stocking a warehouse full or carrying a truck load of connectors. Eight sizes cover just about every cable size... #8 thru 2000 MCM Aluminum or 1780 ACSR.



Four particular features shown in end-view are:

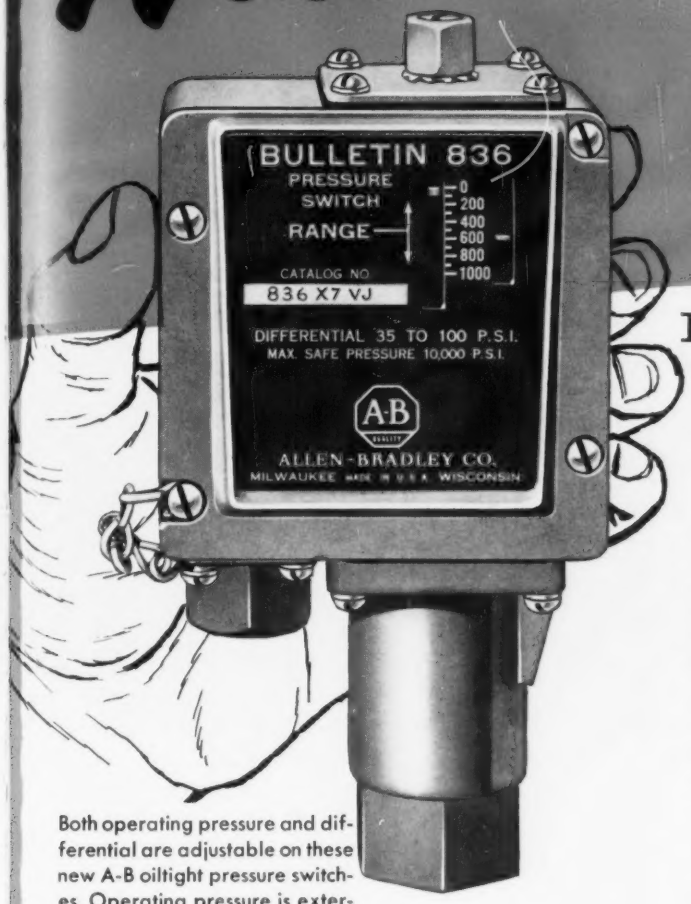
1. **Modified V-groove that assures good conductivity. Wiping action removes oxide film.**
2. **Wide belled cable entrances prevent cable chafing.**
3. **Interlocking tabs confine cables and prevent cable splaying.**
4. **Recessed bolt head pockets permit one hand installation.**

BURNDY 58-30

Norwalk, Connect. In Europe: Antwerp, Belgium Toronto, Canada

New ALLEN-BRADLEY OILTIGHT PRESSURE SWITCHES

Bulletin 836 Type T



Both operating pressure and differential are adjustable on these new A-B oiltight pressure switches. Operating pressure is externally adjustable, and setting shows on calibrated scale. A trip indicator shows operating point.

For machine tool hydraulic systems—operating at pressures up to 5,000 psi

Especially designed for heavy duty industrial applications, these new Allen-Bradley oiltight high pressure switches assure long, trouble free life. The attractive die-cast aluminum enclosure is completely sealed to exclude oil and water. The snap-action switch mechanism maintains its high contact pressure to the point of switchover—no matter how slowly it is approached. Contact chatter is eliminated—trouble free contact life is increased. The contact block has two isolated circuits with one N.O. and one N.C. set of contacts.

Send for complete information on this newest addition to Allen-Bradley's wide line of *quality* pilot controls.

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis.
In Canada: Allen-Bradley Canada Ltd., Galt, Ont.

ALLEN-BRADLEY
MOTOR CONTROL
QUALITY

Internal view of piston design used on units for systems above 500 psi. Bellows type construction is used up to 500 psi.

Also...A New Line of Pressure and Temperature Controls with Lower Differentials

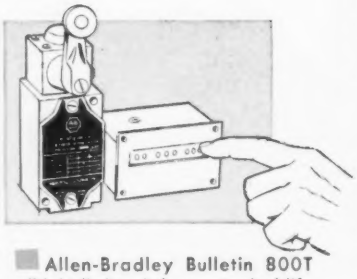
Bulletin 837 Type A temperature control with new lower differentials. Ranges up to 490°F.

Bulletin 836 Type A pressure control with new bellows that provide ten times longer life. Operating ranges up to 900 psi.

2-59-MR

Allen-Bradley is not satisfied until Limit Switch Life runs into

MANY MILLIONS OF OPERATIONS



Allen-Bradley Bulletin 800T oiltight limit switches on typical life tests have run many millions of operations. Write for complete information on the Allen-Bradley line of quality limit switches for every industrial application.

Here are some new—and some old—Allen-Bradley oiltight limit switches—all built to give you extra millions of trouble free operations. Their switch bodies and operating heads are both sealed. Oil, dirt, and metal chips cannot enter and foul the contacts or cause sluggish operation of the momentary contact mechanism. Double break, silver alloy contacts never need maintenance. The snap action switch is positive insurance against any reduction of the contact pressure as the "trip point" is approached. This means less chance for chatter and arcing of relays, contactors, or starters operated by the limit switch—and prolonged trouble free contact life for the limit switch itself.

The Allen-Bradley line of limit switches is complete. Illustrated are only a few variations.

Side Push Rod

Top Push Rod with Plastic Window

Roller Lever for Flush Mounting

Neutral Position Momentary Contact Limit Switch. One set of contacts is closed for each direction of operation.

Adjustable Rod

Adjustable Roller Lever

Wobble Stick Type

Fork Lever Type

Side Push Roller

Roller Lever for Manifold Mounting

Side Push Rod Maintained Contact

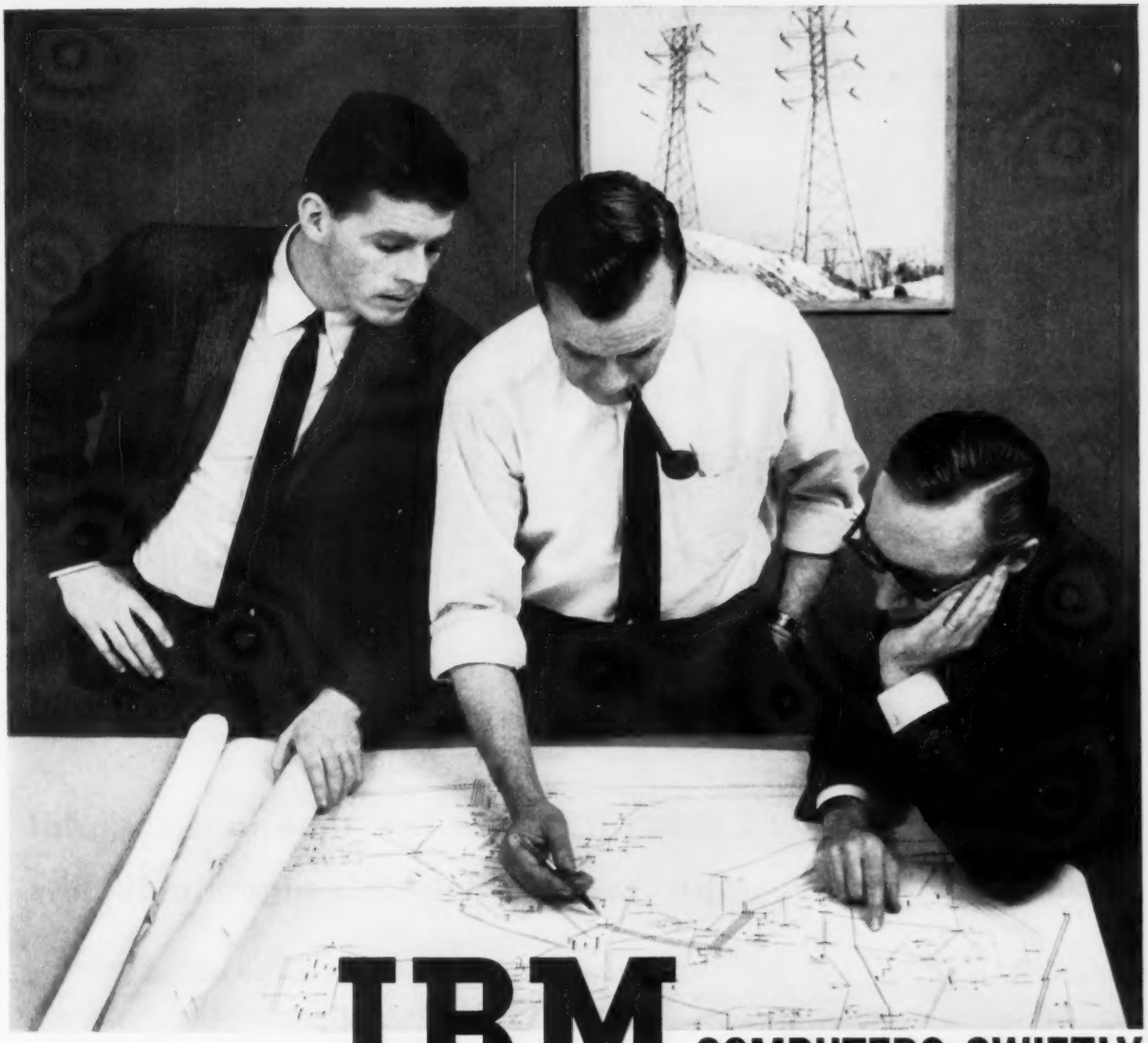
2-59-MR

ALLEN-BRADLEY

MOTOR CONTROL

QUALITY

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis.
In Canada: Allen-Bradley Canada Ltd., Galt, Ont.



IBM® COMPUTERS SWIFTLY DETERMINE NEW TRANSMISSION LINE REQUIREMENTS

Today, for even the toughest problems in line design, transmission engineers are finding quick answers with IBM digital computers.

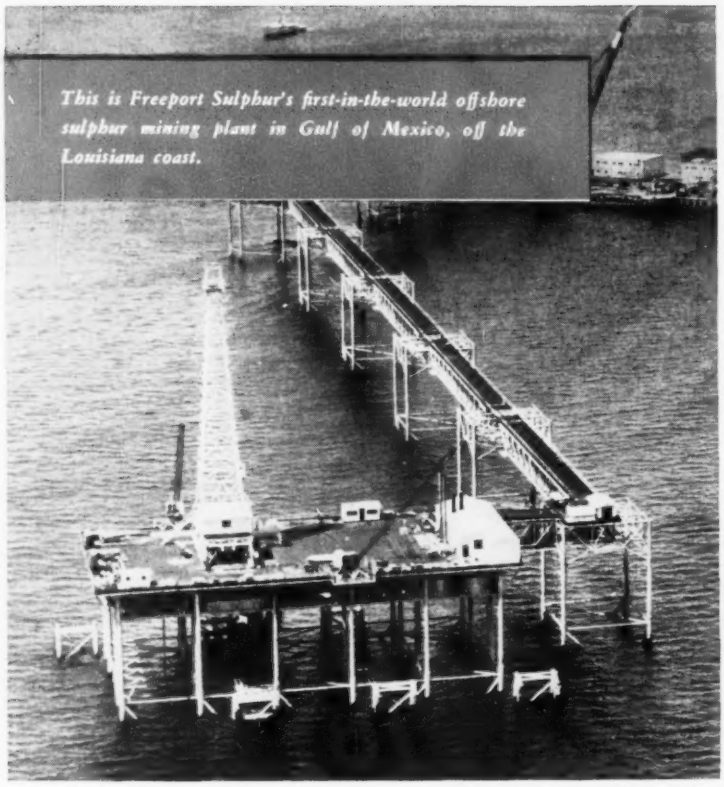
Basic line requirements, obtained from IBM digital load flow studies, represent one segment of computer usage in transmission systems. In addition, IBM computers ascertain self and mutual impedances; give most economical conductor sizes; make sag and tension computations and solve tower design problems. As a result, engineers are freed from routine calculations and are able to devote more time to creative systems planning.

IBM digital equipment offers the transmission engineer many advantages: accuracy sufficient for loss studies; no transcription errors; ability to study high and low voltage systems using a common MVA base; table look-up operations; fast logical decision functions; and immediate availability.

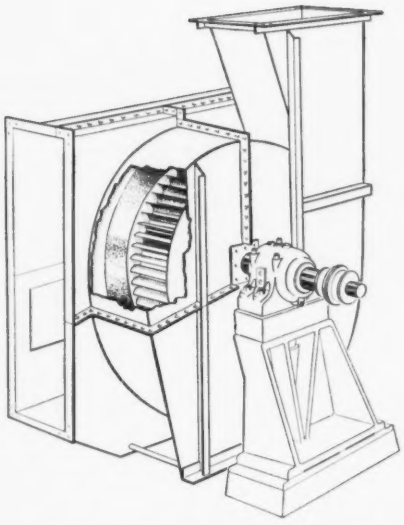
Not confined to special purposes, IBM equipment can be used by both Engineering and Accounting Departments.

IBM's more than 44 years of service and experience are available to you through your local representative.

DATA PROCESSING DIVISION
INTERNATIONAL BUSINESS MACHINES CORPORATION, N.Y., N.Y.

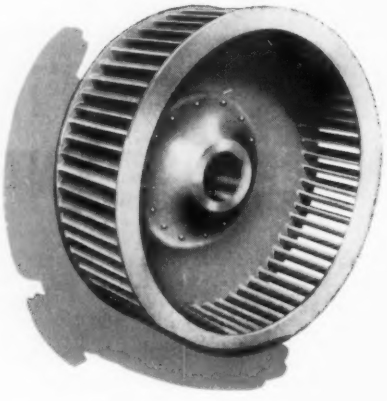


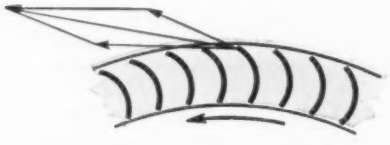
This is Freeport Sulphur's first-in-the-world offshore sulphur mining plant in Gulf of Mexico, off the Louisiana coast.



This is Green's MC type fan, 4 of which were supplied to Freeport Sulphur—each with 54" wheel, producing 67,800 CFM against 18" S.P. at 715°.

FREEPORT SULPHUR'S doing it for the first time in the world! and Green MC type fans will help this gigantic air lift!





It's the forward curve at BOTH tip and heel of fan blades that does the job on Green MC type fans.

Freeport Sulphur had a tough engineering problem.

For their world's first offshore sulphur mining operation, Freeport Sulphur has to compress truly tremendous air volume to air lift liquid sulphur to the surface. Fans are needed for the steam operating unit compressing this air.

Rugged, dependable fans are required. Also, fans that need but a minimum of working space.

Where did Freeport Sulphur get such fans?

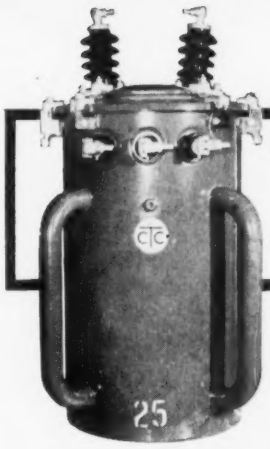
Easy — they ordered Green MC type fans. These fans are not only rugged, but the MC is the smallest fan that can be used to perform any required job.

You, too, might solve a vexing engineering problem by calling on Green.

Green

THE GREEN FUEL ECONOMIZER CO., INC.,

BEACON 3, NEW YORK



CENTRAL TRANSFORMERS GIVE
Better Performance
because...

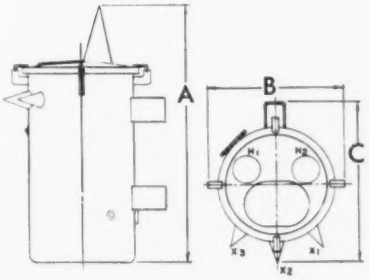
The NEW "H" CORE

...ASSURES YOU THAT CENTRAL TRANSFORMERS FEATURE...

- ✓ Lower Losses
- ✓ Lower Exciting Current
- ✓ Lighter Weight
- ✓ Smaller Size

Central's new "H" CORE is precision-wound on special machines designed and built to Central's specifications. This small, compact core assures a more efficient utilization of the magnetic properties of grain oriented steels. The efficiency of the "H" core is further enhanced by Central's new and improved annealing process. The smaller core also has permitted improvements in the design of the coil and other components—all of which adds up to transformers that give . . .
BETTER PERFORMANCE!

EXAMPLE: Central's 25KVA 7620/13,200Y to 120/240, no taps.



MECHANICAL DATA	1957	1959
A —	42 in.	40 in.
B —	25 in.	21 in.
C —	26 in.	26 in.
Weight	535 lbs.	490 lbs.

ELECTRICAL DATA (Average Tested Values)

20% REDUCTION in No Load Loss
8% REDUCTION in Total Loss
18% REDUCTION in Exciting Current

JUST ONE MORE REASON WHY CENTRAL TRANSFORMERS ARE **PREFERRED** THROUGHOUT THE NATION

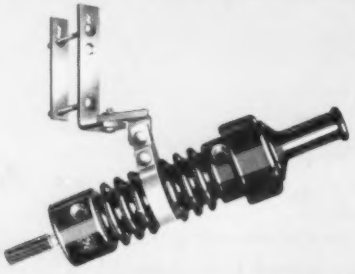
CENTRAL CTC

Sales Offices in Principal Cities
Transformer Corporation
Telephone JEfferson 4-5332
PINE BLUFF, ARKANSAS

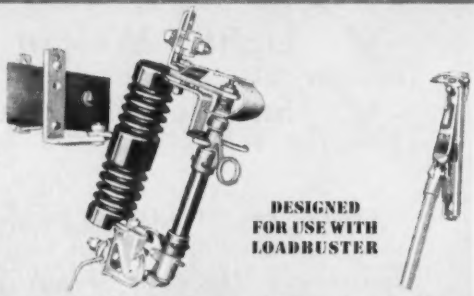
NEMA

For every distribution system

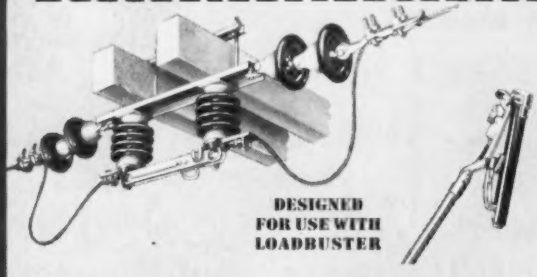
Four devices for low cost load switching at today's higher voltages and loads



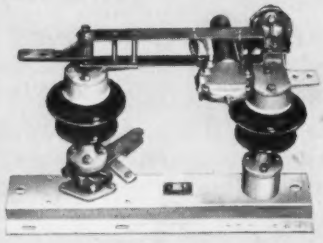
S&C POSITECT—enclosed cutout for full load switching, up to 200 amperes at 5 kv (or as a disconnect—unfused—to 300 amperes). Continuous rating: 50 and 100 amperes as cutout, 100 and 300 as disconnect. Note interrupter attachment at left.



S&C XS CUTOUT—an open cutout designed for use with LOADBUSTER®. Rated 100 amperes continuous as a cutout or 200 amperes continuous with disconnect blade. With LOADBUSTER it will switch full load, and associated charging and magnetizing currents.



S&C LOADBUSTER DISCONNECT—a distribution disconnect, with full published ratings and station-type performance. Rated 15 kv, 400 amperes continuous, 20,000 amperes momentary—95 kv or 110 kv BIL. With LOADBUSTER it can switch all loads, and associated charging and magnetizing currents.



S&C ALDUTI LOAD INTERRUPTER—SIDEBREAK STYLE—three-pole load switching device of long recognized capability. Used primarily for key sectionalizing points. Will interrupt all loads through 600 amperes. Made in 7.2 and 14.4 kv ratings.

S&C ELECTRIC COMPANY

Load switching is a real concern in modern distribution systems, with line voltages of up to 14 kv and load currents as high as 600 amperes. At these voltages and loads, it is impossible or extremely hazardous to open main or branch feeders with ordinary disconnects and cutouts.

Dropping all loads at the source, simply to open a single branch feeder, results in intolerable service interruptions. One alternative—switching with link-break cutouts—is an undependable makeshift. Another alternative—group operated disconnects—still doesn't bring full positive load switching, and is costly.

The S&C solution is a complete "stable" of distribution cutouts, disconnects, and load interrupters—all capable of providing full load switching, at prices to match distribution system economics.

The POSITECT Enclosed Cutout has its own load interrupter attachment. Two other devices—the XS Open Cutout and the Tool Operated Disconnect—are designed to take S&C's portable loadbreak tool, LOADBUSTER®. Finally, the S&C ALDUTI Load Interrupter has a built-in interrupting unit. This reliable interrupter switch has been the standard of the industry for many years.

For additional information on how to give your distribution system universal load switching capability, write to S&C.

S&C Electric Company
4421 Ravenswood Ave.,
Chicago 40, Ill.

In Canada: S&C Electric
Canada, Ltd.
8 Vansco Road,
Toronto 14, Ontario

Disconnects • Cutouts • Fuse Links
• LOADBUSTER • Power Fuses •
Interrupters • Metalclad Switchgear

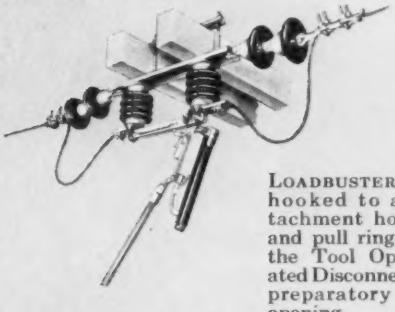
Specialists in High-Voltage Circuit Interruption Since 1910

LOADBUSTER®...

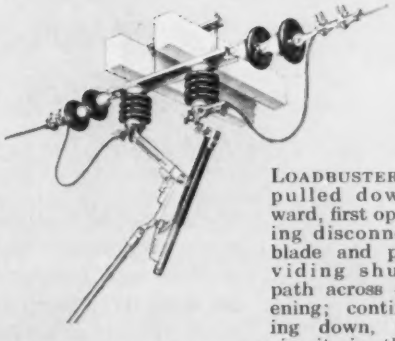
S&C's portable loadbreak tool

This new portable loadbreak tool is used at the end of a universal hook stick for opening disconnects and cutouts designed for use with it. On today's heavy loads, to 400 amperes, and up to 15 kv, this device gives arc-free load switching.

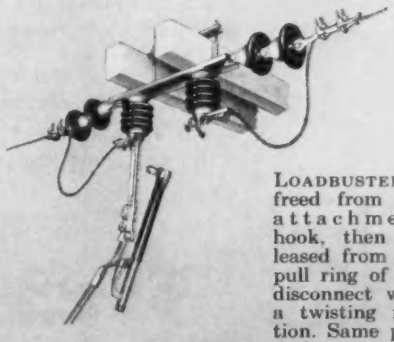
S&C manufactures two distribution devices mated to LOADBUSTER, the Tool Operated Disconnect and the XS Open Cutout. The sequence below illustrates LOADBUSTER opening the S&C Tool Operated Disconnect.



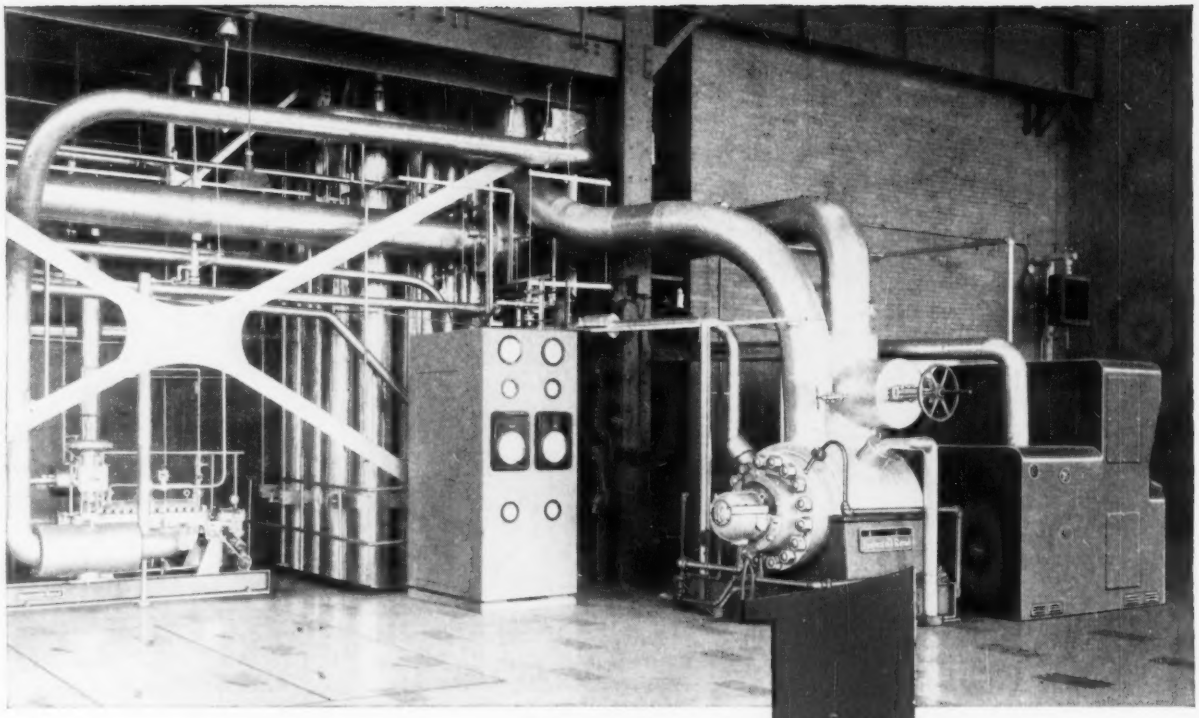
LOADBUSTER is hooked to attachment hook and pull ring of the Tool Operated Disconnect, preparatory to opening.



LOADBUSTER is pulled downward, first opening disconnect blade and providing shunt path across opening; continuing down, the circuit is then interrupted in LOADBUSTER, which latches open.



LOADBUSTER is freed from the attachment hook, then released from the pull ring of the disconnect with a twisting motion. Same procedure is followed for cutouts mated to LOADBUSTER.



FULL-CAPACITY PUMPS... ONE per boiler

I-R High-Speed Boiler-Feed Pump at Appalachian Power Company's Glen Lyn Station is the first of 8 Identical I-R Units installed on the American Electric Power System

The Ingersoll-Rand boiler-feed pump shown above represents a radical departure from previous central station practice. Instead of the usual three-pump arrangement with two normally carrying full load, in this installation one main pump supplies all the feedwater required for the 225 MW Glen Lyn Unit No. 6. This unit first operated in May 1957. The last of seven more I-R full capacity boiler-feed pumps like the one shown above is currently being installed.

In addition to making important savings in first cost and operating cost, the turbine-driven full-capacity pump improves cycle performance and heat balance conditions by using extraction steam from the main turbine to drive the pump and exhausting this steam to feedwater heaters.

Each pump, rated 1,500,000 lb/hr at 2400 psig and 5400 rpm, is driven directly by a General Electric turbine. Pumps are of 4-stage, double-case construction with "Unit-Type" rotor assembly and floating-ring type stuffing boxes. Boiler start-up is handled by a smaller auxiliary motor-driven I-R feed pump, barely visible in the left background above.

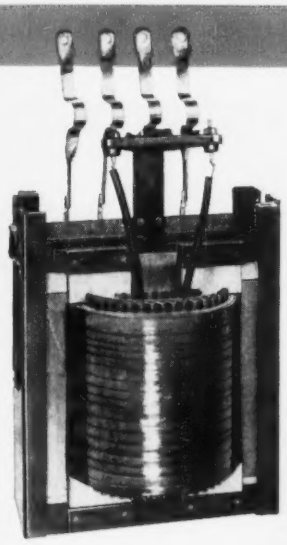
In addition, American Electric Power will soon put into operation the *world's largest* boiler-feed pumps—two 22,000 hp I-R full capacity units serving new 450 MW generators at two AEP stations.

For further details on full-capacity boiler-feed pumps, or any other boiler-feed units, contact your Ingersoll-Rand sales engineer.

Ingersoll-Rand

10-906 ◆ 11 Broadway, New York 4, N. Y.

COMPRESSORS • GAS & DIESEL ENGINES • PUMPS • AIR & ELECTRIC TOOLS
CONDENSERS • VACUUM EQUIPMENT • ROCK DRILLS



The complete line of new transformers, ranging in size from 3 to 167 KVA, in both Conventional and CSP types, are now available.

MOLONEY ELECTRIC'S

new distribution transformers have leads insulated and protected with

NATVAR 400

Moloney Electric Company, St. Louis, recently redesigned their entire line of distribution transformers. The paramount change was the development of an entirely new Moloney Core. The new core affords lower exciting current.

The coils have lower losses; and lower impedance which means a lower internal voltage drop at all loads, therefore during peak load periods, the new distribution transformers can carry higher overloads for the same permissible regulation; also, improved voltage regulation at the load.

Liberal use of insulating materials throughout the coils, with extra insulation on the turns at the line ends of the coils, enable them to withstand lightning surges.

Natvar 400 Extruded Vinyl Tubing is used to insulate and protect leads, because it retains its original properties when subjected to both *heat and oil*. It is approved for continuous operating temperatures of 105°C, and immersion in oil has no adverse effect on its flexibility, its mechanical, or its dielectric strength.

Natvar 400 and other Natvar flexible electrical insulating materials are uniformly good. They are available either from your wholesalers' stocks or direct from our own.

Natvar

Natvar Products

- Varnished cambric—cloth and tape
- Varnished canvas and duck
- Varnished silk and special rayon
- Varnished—Silicone coated Fiberglas
- Varnished papers—rope and kraft
- Slot cell combinations, Aboglas®
- Isoglas® sheet and tape
- Isolastane® sheet, tape, tubing and sleeving
- Vinyl coated—varnished tubing and sleeving
- Extruded vinyl tubing and tape
- Styroflex® flexible polystyrene tape
- Extruded identification markers

We will be very happy to supply information on any of our products on request.

NATVAR CORPORATION

FORMERLY THE NATIONAL VARNISHED PRODUCTS CORPORATION

TELEPHONE FULTON 8-8800

CABLE ADDRESS NATVAR: RAHWAY, N. J.

221 RANDOLPH AVENUE • WOODBRIDGE, NEW JERSEY

Here's a man with . . .
the ans
10
Standard
"HOW TO INCREASE OVERLOAD CAPACITY"
"HOW TO INCREASE VOLTAGE AT THE METER"
"HOW TO SELL MORE OF PRODUCED POWER"
"HOW TO REDUCE COPPER LOSSES"

s wers on his desk

• Try the all-new Super Standard Type SWA on your slide rule or your system. It's a new approach to transformer design and efficiency that came FIRST FROM STANDARD. Now you can conquer the high cost of changeouts with dramatic revenue increases that return as much as 66% of transformer investment in a year. The 50 KVA, 2400 V unit reduces copper losses by 30% or more at full load!

This is the transformer that major utilities are putting on test NOW. It meets the three major demands for transformer efficiency:

LOW IMPEDANCE which, in turn, means better voltage at the meter, fewer service complaints and increased revenue. You deliver more of the power you produce.

LOW TEMPERATURE RISE without excessive voltage drop. There's no excessive heating . . . fewer burnouts.

LOW COPPER LOSSES that are sufficient to pay for the transformer!

Want to know how much the dramatic new Standard Type SWA can increase revenues on your system? The Standard Transformer representatives have the facts. Ask the man in your area. And ask us for the new Standard Distribution Bulletin S-401-C. It tells all about the new Type SWA. It's a first and IT'S FIRST FROM STANDARD.

40th ANNIVERSARY 1918 1958

40 years of concentration on transformer design exclusively

Phone Warren
EXpress 2-1563

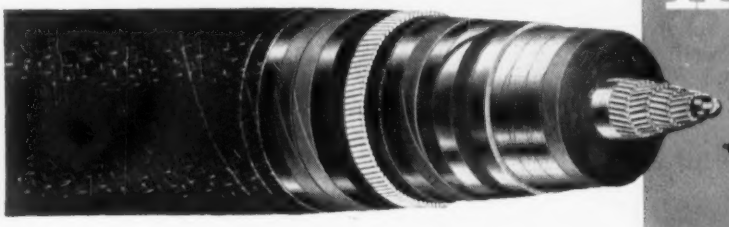
Standard Transformer CO.
WARREN, OHIO
"WHEREVER THERE IS POWER"

The Kariba Dam is being built on the Zambesi River to provide hydro-electric power for Central Africa.

Transmission equipment for this project is being manufactured by BICC. Altogether orders for this company total some ten million dollars and include a specially designed 330,000 volt single-conductor oil-filled cable — at present being manufactured — which will connect the underground power house to the overhead transmission lines. This will be the highest voltage cable ever installed in Africa.

the 330,000 volt Kariba Cable

the highest voltage in Africa



experience

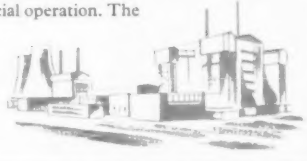
keeps BICC *in the lead*

D.S.O. FOR ECONOMY

The Ductless, Shaped-conductor Oil-filled cable is BICC's latest development in 33kV transmission. Dispensing with fillers and built-in ducts, it costs less than a conventional cable of equal duty.

CABLES FOR THE FIRST NUCLEAR POWER STATION

BICC supplied cables and accessories for Calder Hall, England, the first nuclear power station in commercial operation. The cables included specially designed types resistant to intense radiation and heat, for operating the fuel charging and discharging grabs.



THE FIRST I.P. CABLES IN SOUTH AMERICA

In face of fierce international competition BICC 69kV Impregnated Pressure Cables were selected for power transmission in and around fast-growing Porto Alegre, Brazil.

How do you learn about electric cables?

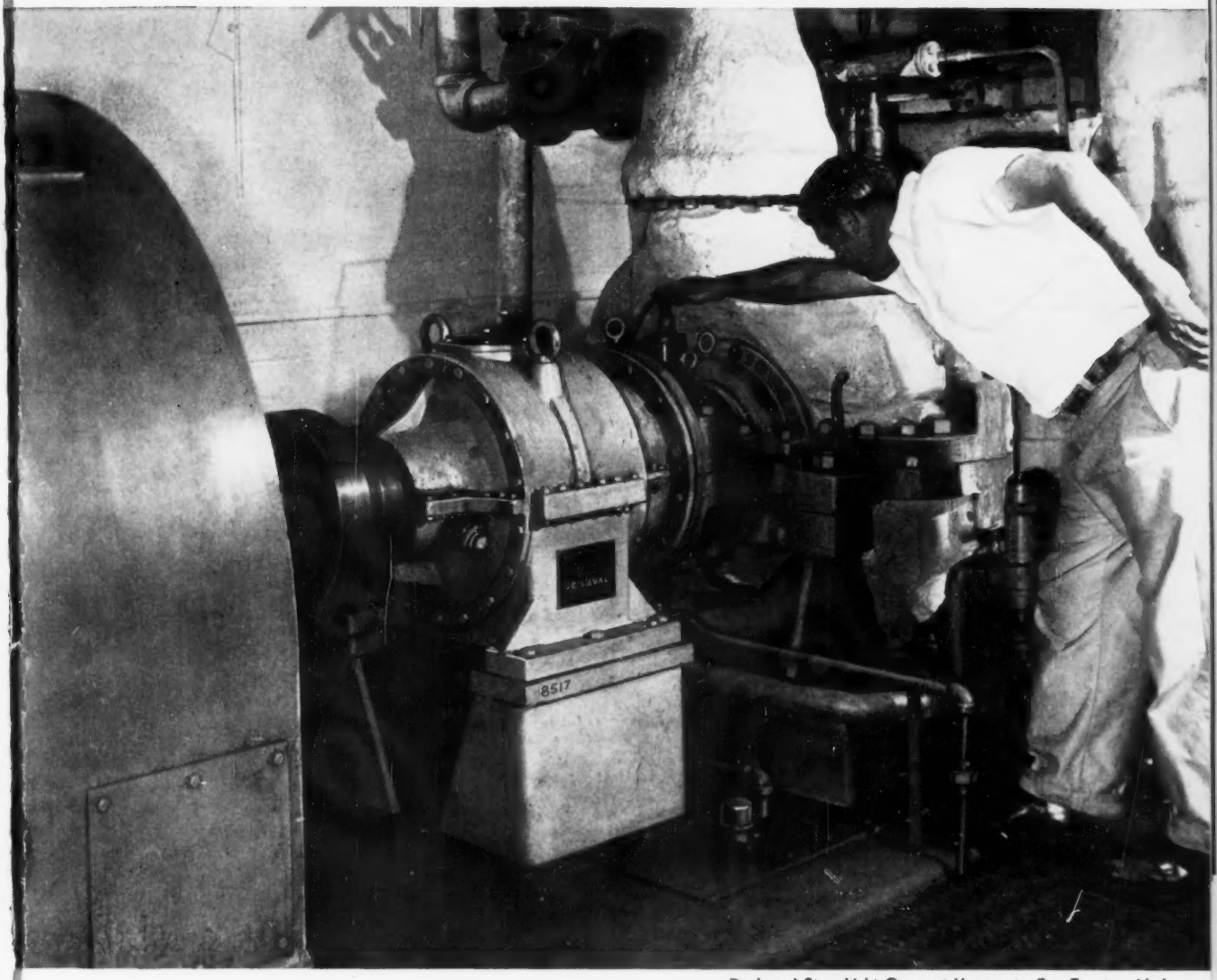
By making them, testing them, installing them, studying them in operation, finding new materials and better designs, and then starting all over again. Years of doing this for every type of electric cable and accessory — that's where BICC's experience came from. Here are some of the results.

BICC the World's largest cablemakers

BRITISH INSULATED CALLENDER'S CABLES LIMITED

Technical Representative in U.S.A., Arthur F. Coventry, 11 West 42nd Street, Suite 442, New York 36, N.Y.

Creative Engineering by DE LAVAL



De Laval-Stoeckicht Gear at Homasote Co., Trenton, N. J.

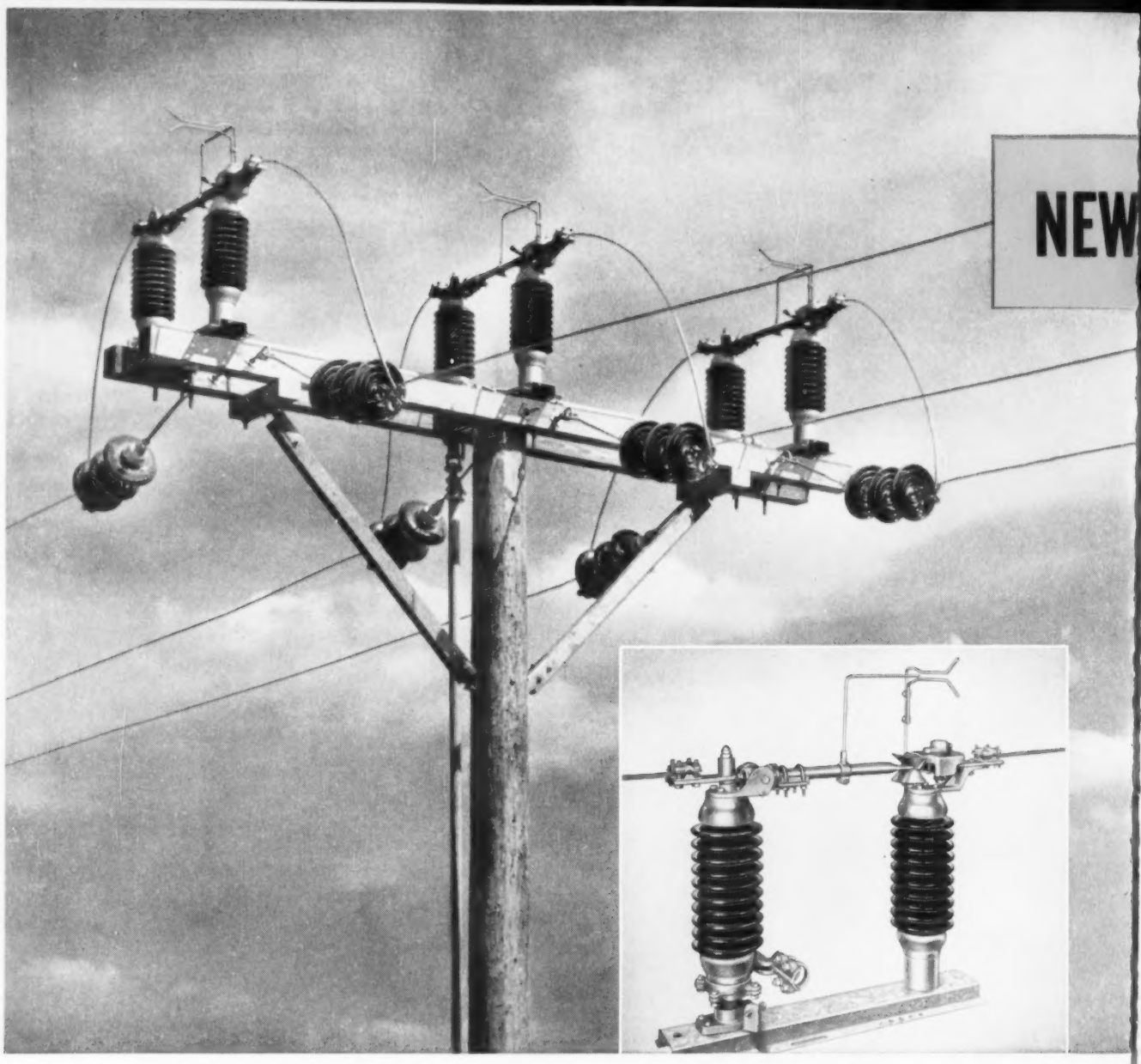
2800 Horsepower in a 22" package!

That compact "package" you see in the center of the picture above is a De Laval-Stoeckicht Planetary Gear. Developed by W. G. Stoeckicht in Germany, this gear has been proved in hundreds of European installations. It is capable of transmitting 2800 horsepower from the steam turbine at the right to the generator at the left. It weighs only 900 pounds. A conventional gear for this service would weigh 4000 pounds. And the De Laval-Stoeckicht gear takes up less than half the space of a conventional gear. This is another example of how De Laval *creative engineering* plus precision manufacturing and highest quality control assure lasting customer satisfaction.

DL 440

DE LAVAL *Steam Turbine Company*

861 Nottingham Way, Trenton 2, New Jersey



NO OTHER SIDE-BREAK DISCONNECT GIVES YOU ALL OF THESE OPERATING ADVANTAGES

- **Correct contact always maintained at blade tip even if crossarm warpage distorts the switch base.**
- **All blades engage fully in the break-contact jaws without precise adjustment of the inter-phase rods.**
- **Less time and labor to install with Kearney original wide-tolerance mechanical design.**
- **Easiest, surest ice-breaking ability available on both opening and closing.**

This newest Kearney development solves long-existing operating problems of crossarm mounted group operated side-break disconnects. The best supporting structure or crossarm construction may . . . due to ice loads, age, wind or line strain . . . deflect enough to distort the switch bases, or alter the relative positions of the three phases. This often causes loss of contact or failure of all blades to close completely in conventional disconnects with both rigid blades and stationary break-contacts.

Kearney's advanced design features a self-aligning blade constructed to permit controlled vertical movement and axial rotation. This automatically compensates for base distortion . . . keeps the blade tip correctly aligned in the contacts. The break-contact swings 30-degrees with the blade as it is opened or closed, producing high leverage ice-breaking ability and full wiping of the silver current transfer surfaces. On closing, the blade tip fully engages the break-contact before the contact moves from its angular open position, compensating for any shift in position of the switch bases. This same feature also allows considerable freedom in interphase rod adjustment, enabling Kearney ***Self-Aligning*** side-break switches to be installed faster and more economically than other types.

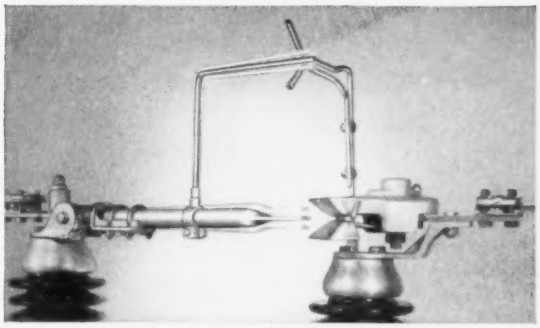
The details of these original features for maintenance-and-adjustment-free operation are shown on the facing page.

Kearney's

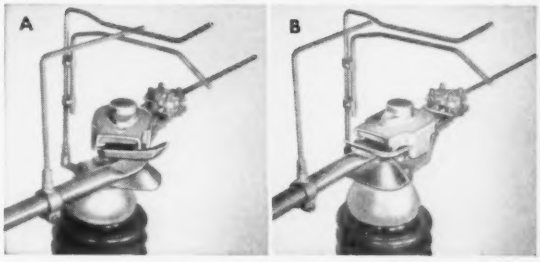
Self-Aligning SIDE-BREAK DISCONNECTS

...always make positive contact, even if the supporting structure warps, twists, bows or settles.

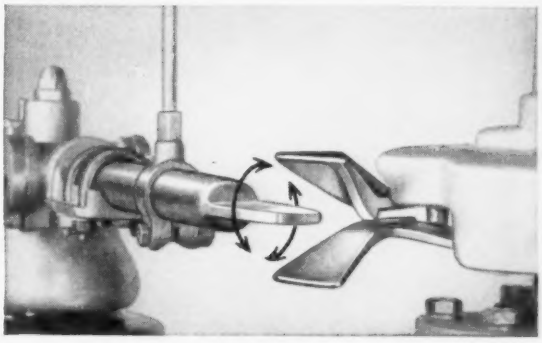
Self-aligning blade moves in a vertical plane to re-establish the original relationship between blade tip and contacts if supporting structure warpage distorts switch base. Wide mouth contact jaws assure blade entry into the contacts. Vertical 1¼" movement more than corrects for extreme cases of misalignment.



Break-contact swings 30° in the plane of blade travel as switch is opened or closed, providing highest leverage ice-breaking and full wiping of the current transfer surfaces. Note that the blade tip is fully engaged, and full contact is maintained (A) through the final 20° of blade travel to the fully closed position shown at (B). This feature allows more latitude in phase rod adjustment than other designs.



Blade rotates 12° on its longitudinal axis. If base distortion has affected blade-contact alignment, the blade tip will rotate as it enters the break-contact to keep all contact surfaces parallel, automatically restoring contact alignment. Friction reducing construction at all rotation points minimizes operating effort.



Switch carries full-rated load current well within NEMA temperature rise, from a fully closed position to 20° partially open position. Ratings available, 7.5 through 69 kv, 600 amperes. Equipped with conventional or whip-type arcing horns... torsional or spade-type operating mechanism. May be mounted horizontally, vertically, or underhung.

For full details talk to your Kearney representative, or write direct for Bulletin 8B.

JAMES R. KEARNEY CORPORATION

4224-42 Clayton Avenue, St. Louis 10, Missouri

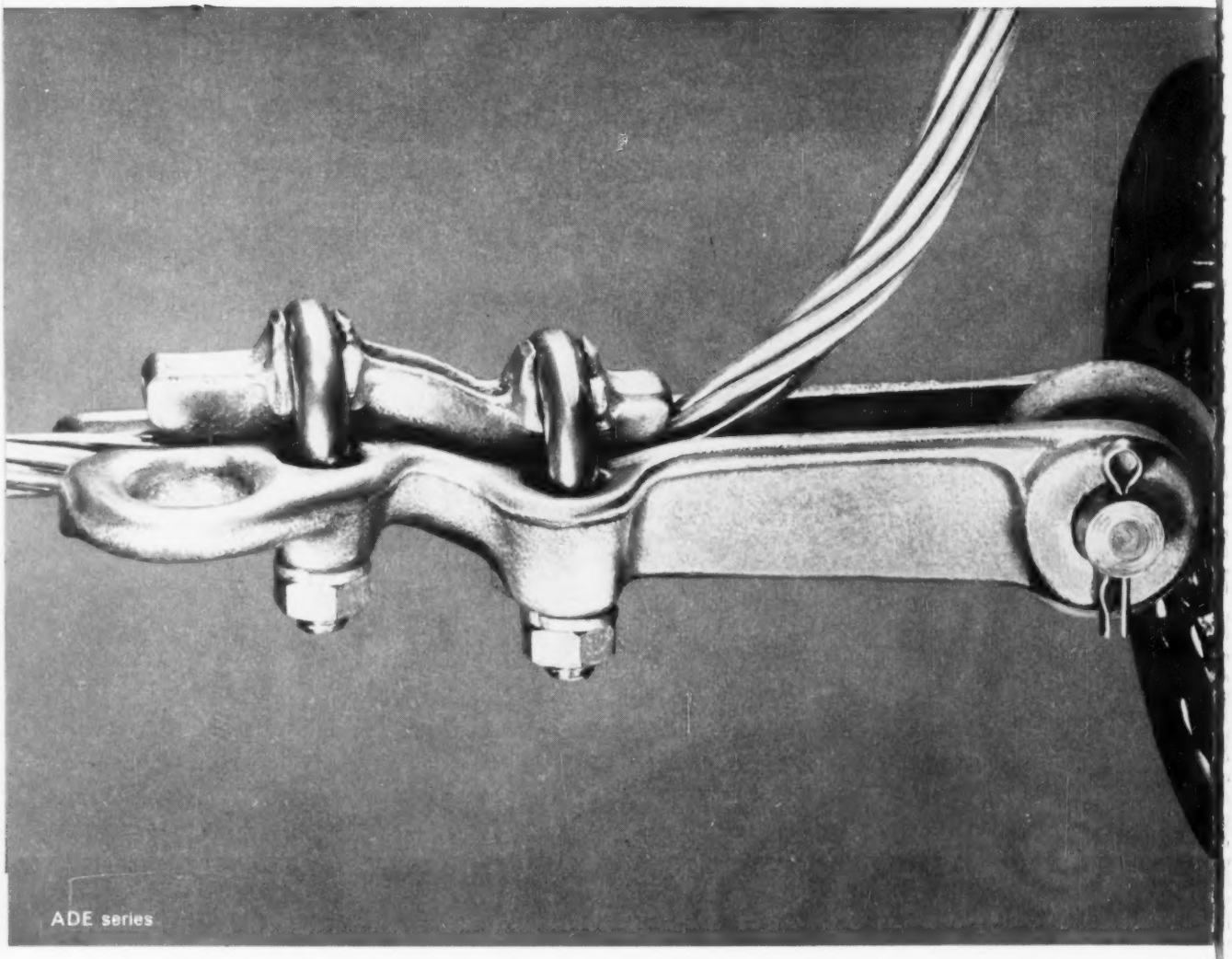
397

FOR BETTER CONSTRUCTION... SAFER MAINTENANCE

Specify Kearney Products

Plants at: **ST. LOUIS • FAYETTEVILLE, ARKANSAS • SHENANDOAH & CLARINDA, IOWA • GUELPH, ONTARIO, CANADA**

grip...



ANDERSON ELECTRIC

Anderson's exclusive Snub-Seat straight line clamp has higher holding power than comparable clamps. Built for trouble-free service, its unique "working" features facilitate hot line work, distribute pressure preventing cable damage.

ANDERSON ELECTRIC CORPORATION
Birmingham 1, Alabama

Export Representative: International Standard Electric Corp.

Aluminum & Bronze Power Connectors • Clamps • Fittings •Accessories for SUBSTATION • TRANSMISSION • DISTRIBUTION • UNDERGROUND

First choice of
THOSE WHO BUY THEM . . .

WESTERN RED CEDAR POLES

Preferred by
THOSE WHO CLIMB THEM . . .

Nature's finest . . . Western Red Cedar Poles are uniform, lightweight, safer, straighter, sturdier . . . *clean to climb.*

Positive protection against age, weather and fungi by the Thermal Process with PENTAchlorophenol (to EEI or AWPA specifications). Western Red Cedar Poles are immune to disease, rot and deterioration. Pole life is unsurpassed . . . yearly pole-line maintenance negligible.

Avoid Expensive Replacement Costs
Insist on . . .

WESTERN RED CEDAR POLES
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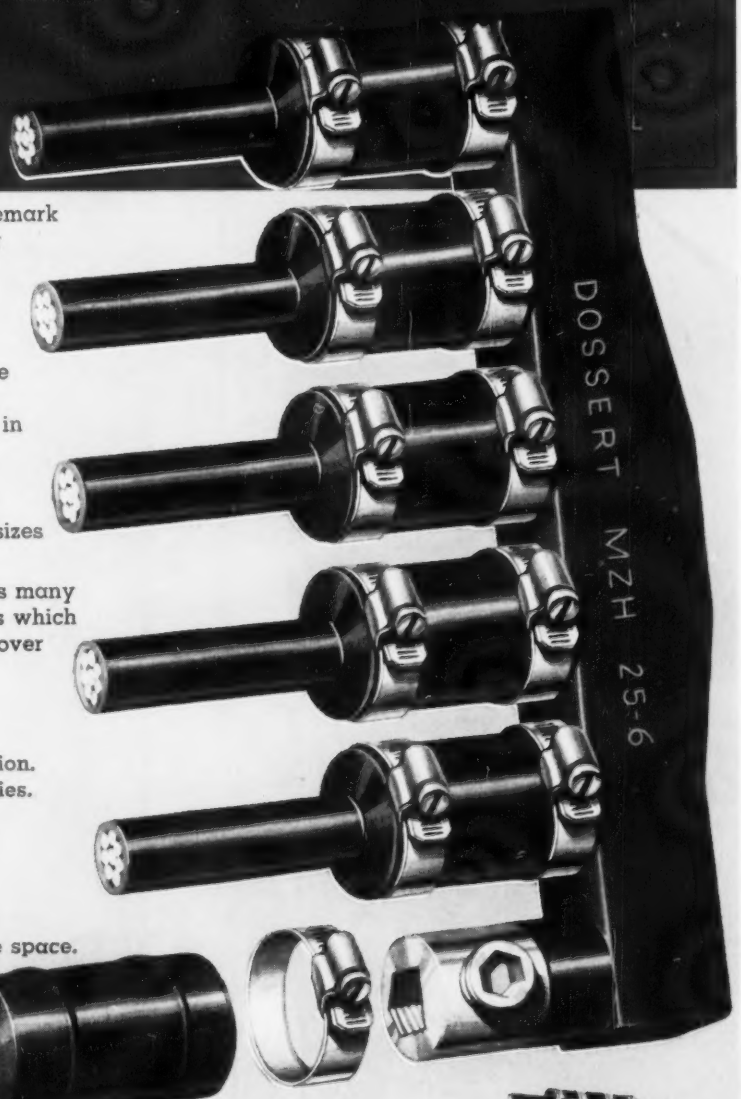
DOSSERT MICON*

(Tapeless Underground Connector)

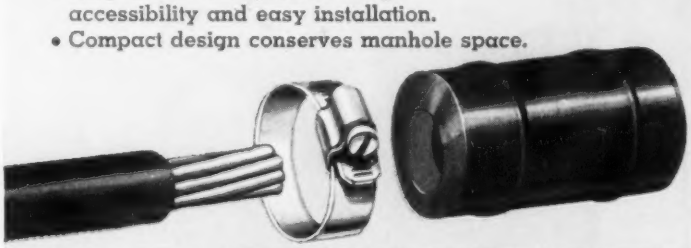
More COMPACT
More RELIABLE
LOWER in COST

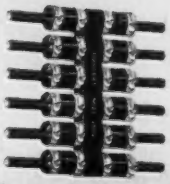


MICON is a Dossert Mfg. Corp. trademark for a tapeless underground connector especially designed for residential and industrial underground distribution systems. This brand of connector is fully insulated for joining up to 8 electrical cables where watertightness must be insured. MICON tapeless connector is simple in concept and well proven principles have been used in its design. No extra components are needed to accommodate a wide range of cable sizes in any outlet position.

MICON brand tapeless connector has many outstanding features and advantages which constitute a substantial improvement over older style and competitive fittings. The most important ones are:

- Lower cost of complete fitting.
- Less field time required for installation.
- Wide cable range without accessories.
- No plastic parts to crack or chip.
- No extra bushings required to fit different insulations.
- All parts are designed for easy accessibility and easy installation.
- Compact design conserves manhole space.





Dossert MICON brand tapeless Crab-type Connector is especially designed for joining up to 12 electrical cables. This connector is an original Dossert design and adheres to the same principle as the tapeless type. Write for special catalog.

Request also complete UNDERGROUND CATALOG UG 53-1

*Pat. Pend. Reg. Trade Mark applied for

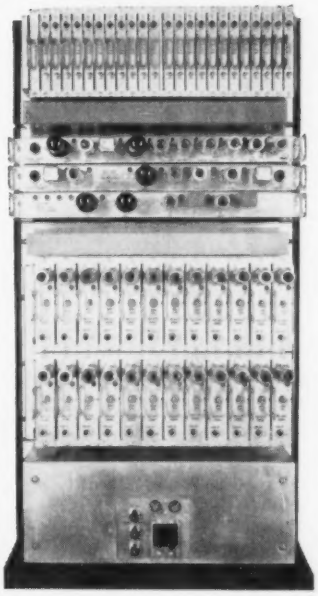
50

DOSSERT MFG. CORP.

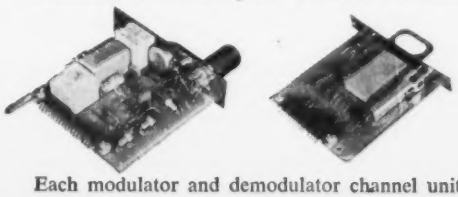
249 Huron Street, Brooklyn, New York

Kellogg Sets New Standards of Reliability in Microwave

Backed by the world-wide technical, manufacturing, installation and operating experience of ITT



New MICROPLEX provides 23 plug-in channel units in 3½ feet of space—a 4:1 size reduction



Each modulator and demodulator channel unit features printed circuitry.

Microwave was pioneered by ITT in 1931 with the Channel crossing from Calais to Dover. Today Kellogg Microwave is achieving new levels of reliability: 99.998%, far superior to wire line systems! Operating in dozens of installations throughout the world, Kellogg's *complete* communications package includes:

- *Microwave* — operating in the 2,000 and 10,000 megacycles bands.
- *Terminating Equipment*—for automating functions, including teletype, telemetering, remote control, data transmission.

Part of the Kellogg 10-C Microwave System is the new 10-C-2 "Microplex": a 23 or 45 channel PTM multiplexing equipment. It features printed circuits, miniaturized components, minimum maintenance, and occupies only three-and-one-half feet of rack space. All demodulators are semi-passive—only one tube per channel; modulators are passive—no tubes. The 23 channels use 41 tubes with an input of 180 watts —a 5:1 reduction in power consumption.

MICROPLEX may also be packaged in one seven-foot rack to provide 45 channels; or 23 channels with two-wire termination and tone signaling. Signal crosstalk is 62 db and signal-to-noise (F1A) is 70 db for 23 channels.

Our engineering staff is always at your service—ready to discuss your communications problems. Write for complete details.

Kellogg Switchboard and Supply Company,
6650 S. Cicero Avenue, Chicago 38, Illinois.
Communications Division of International Telephone and Telegraph Corporation.

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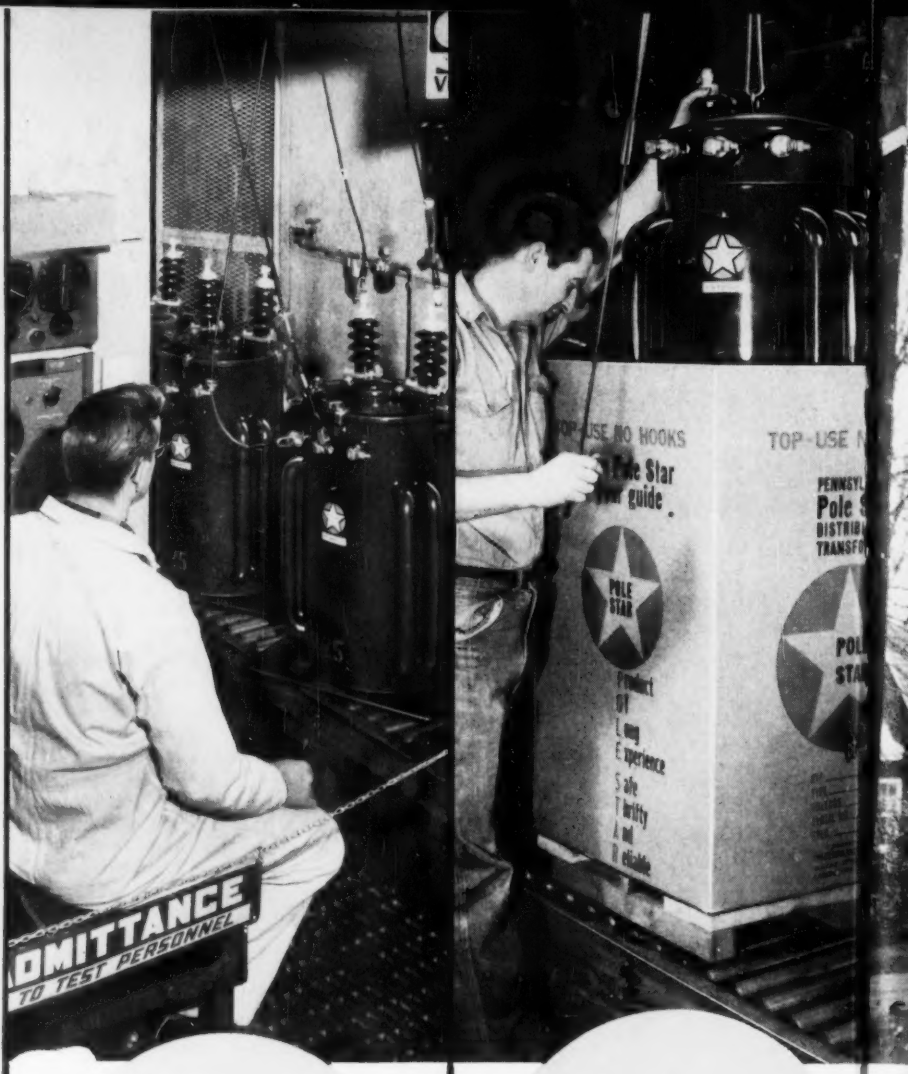
KELLOGG Communications Division of ITT
CHICAGO, ILLINOIS

Product innovations and experimental programs...

POLE STAR'S

continuous contribution to distribution transformer progress



Production-line impulse testing detects even single-turn faults

One of the first manufacturers to begin production-line impulse testing of distribution transformers (in 1956), Pennsylvania Transformer does so with no protective strings attached: that is, Pole Stars are tested *without* arresters. The apparatus used is so sensitive it will detect even single-turn faults. Result: a high-quality transformer is made even better, and purchasers are assured of the greatest possible uniformity of performance.

Perfect Seal Pole Stars are shipped in special corrugated cartons

A double test has been taking place with the shipment of hundreds of Perfect Seal Pole Stars to utilities throughout the country. The completely sealed units—destined for "in service" observation and testing—are being shipped in specially designed corrugated cartons. Advantages of the impact-tested, weatherproof containers—such as better protection, easier disposal and lighter weight—are being carefully checked against customers' experiences and comments.

Pioneer of "higher kva" pole-mounting introduces new 250-kva featherweight

In 1953, Pennsylvania pioneered the pole-mounting of transformers above 100 kva by introducing the Featherweight Pole Star 167-kva unit—an innovation so emulated that industry standards soon were changed to include pole-mounting of 167-kva units. Now, Pennsylvania announces the extension of pole-mounting provisions to 250-kva Pole Stars up to 15 kv. This new Featherweight Pole Star offers the same ease-of-handling features as its 167-kva forerunner.

Experiments with aluminum typify never-ending search for new, better materials

Never content with past accomplishments, Pole Star engineers are constantly searching for even more effective methods, designs and materials. Considerable experimentation has been done, for instance, with aluminum—as a conductor in both oil-immersed and dry-type coils, and as a material for tank covers. Whether measured in terms of later applications or of additional knowledge, the results of such experiments help to assure continued product improvement.

New Pole Star regulator combines direct drive with 32-step regulation

The recently introduced Pole Star Regulator is the only 32-step distribution size regulator that offers a direct-drive tap changer. Based on Pennsylvania's service-proved power-transformer load tap changers, the mechanism features an index-plate method of positioning contacts that assures optimum switching speed, with consequent minimum arcing and extra long life.

PENNSYLVANIA TRANSFORMER DIVISION
McGRAW-EDISON CO.
McGRAW EDISON
CANONSBURG, PENNSYLVANIA
GREATER PITTSBURGH DISTRICT

With 25 years of proven neoprene performance Okonite continues to use it for the tough jobs

For more than 25 years, The Okonite Company has used Du Pont neoprene to protect cable. They know that neoprene coverings stand up under these service conditions: temperature extremes, sunlight and weathering, ozone, corrosive atmospheres, contact with oil and grease and many chemicals. Underground, too, a neoprene jacket resists soil acids and prevents deterioration from galvanic action.

Neoprene's time-proven dependability is your guarantee that above or below ground, you can be confident of long service life when you specify cable jacketed with neoprene.

E. I. du Pont de Nemours & Co. (Inc.), Elastomer Chemicals Dept., Wilmington 98, Delaware.

St. Lawrence power crosses Lake Champlain. The underwater circuit consists of four Okonite 115,000-volt cables. The underground sections from shore line to terminal are protected against soil acid, alkali and moisture with jacketing of Du Pont neoprene.

DU PONT
REG. U. S. PAT. OFF.

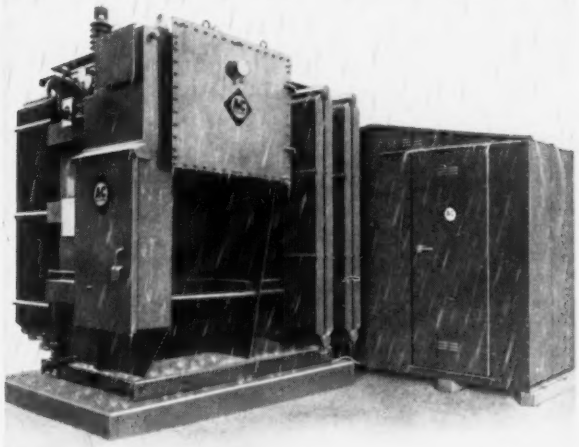
SYNTHETIC RUBBER

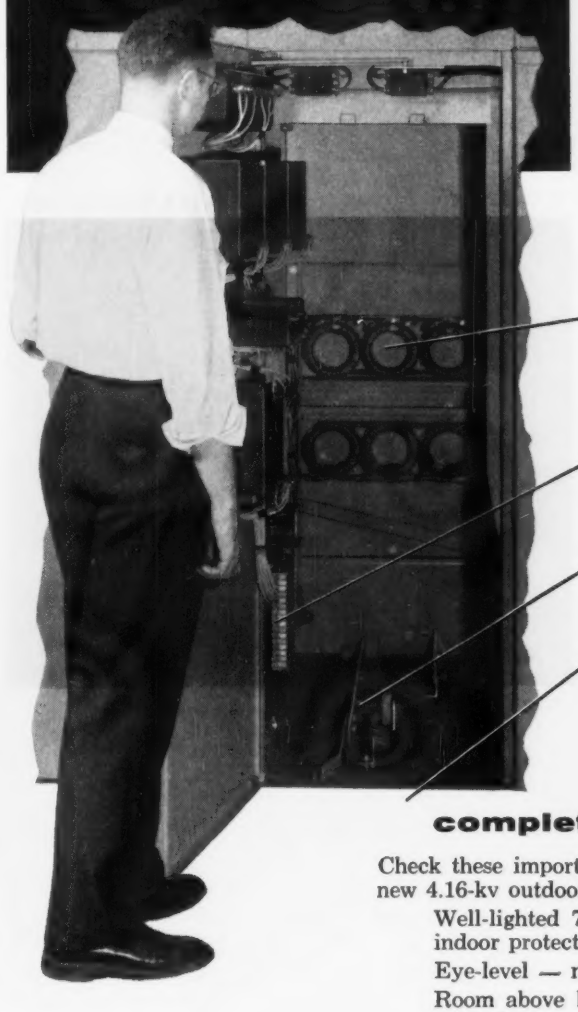
NEOPRENE
HYPALON®
VITON*
ADIPRENE®

BETTER THINGS FOR BETTER LIVING . . . *THROUGH CHEMISTRY*

**Trademark for Du Pont Synthetic Rubber*

ALLIS-CHALMERS modern line for '59





- Aisleway accessibility — current transformers in front of positive-acting shutters.
- Automatic connecting, self-aligning secondary disconnects — no plug jumpers.
- Interlock-guide track self-aligns breaker.
- Flush mounting with floor eases breaker insertion.

NEW Shelter-Clad . . .

completely accessible switchgear

Check these important "accessibility" features of Allis-Chalmers new 4.16-kv outdoor switchgear:

Well-lighted 75-inch-wide service aisle for clean, roomy, indoor protection.

Eye-level — no stretch — instrumentation.

Room above breaker to house potential transformers or control power transformer fuses.

Relay, rectifier, and capacitor elements are mounted on breaker for easy access when breaker is in aisleway.

Standard secondary terminal blocks are accessible from inside aisleway.

In addition to these "accessibility" features, you get *Pyro-Shield* track-resistant insulation plus unique personnel safety features.

Get all the details from your nearby A-C office or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

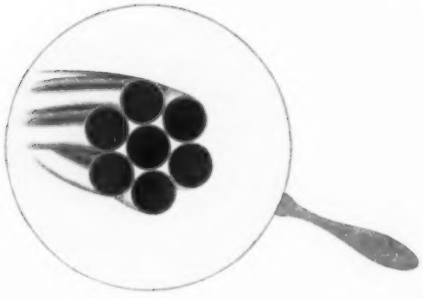
Pyro-Shield and *Shelter-Clad* are Allis-Chalmers trademarks.

A-5918

ALLIS-CHALMERS

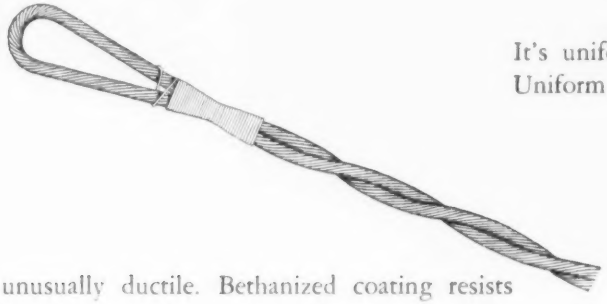
Why Bethanized Coating means full protection

Bethanized coating is the "armor" on Bethlehem strand.

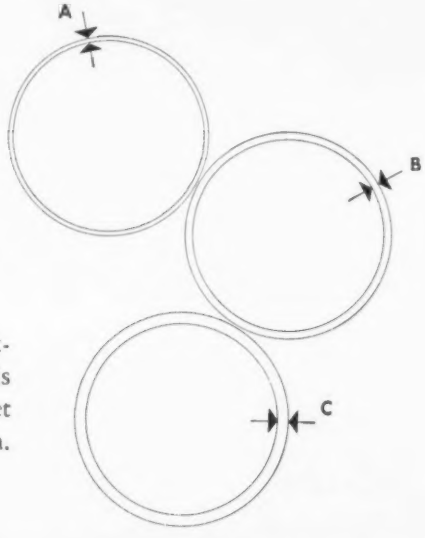


It's highly pure zinc, applied by a carefully developed electrolytic method.

It's uniform in depth. No vulnerable thin spots. Uniform application around each wire.



It's unusually ductile. Bethanized coating resists cracking, peeling, flaking, even under severe bending.



It's available on Bethlehem strand in three separate thicknesses—A, B, and C. A is equal to extra-galvanized. B is twice as thick; C, three times as thick. Thus you can get exactly the right protection for each individual installation.

For the most dependable protection, specify Bethlehem strand with the bethanized coating.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

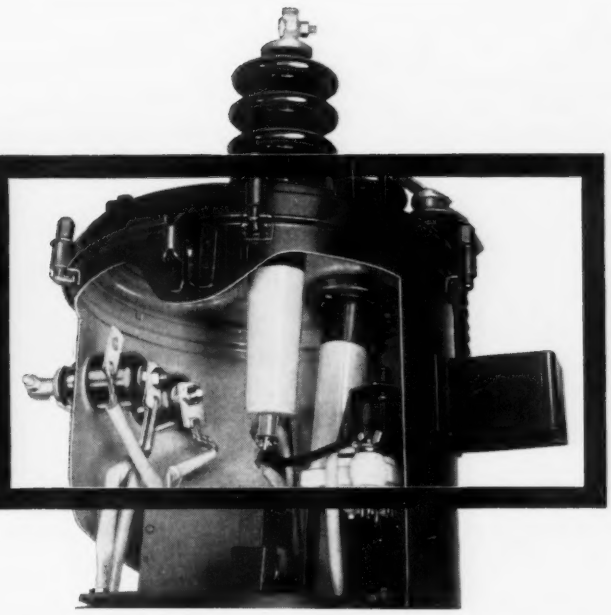
BETHLEHEM STEEL

BETHLEHEM STEEL

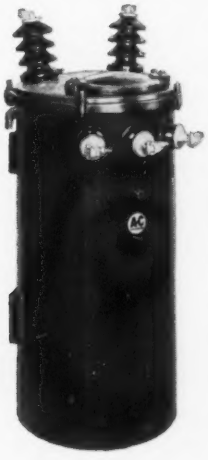
There's a good reason WHY...

Distribution transformer bushings should be

CLAMPED FROM THE INSIDE



smooth surface PREVENTS RUST



SHARP corners of external hardware are especially vulnerable to rust. And once rust has a start, your maintenance problems multiply fast. To eliminate every potential trouble spot, Allis-Chalmers devised *internal* clamping arrangements for bushings. All external hardware has been eliminated without changing the effective method of gasketing. Two-piece low voltage bushings compress and seal the tank wall gaskets through clamping pressure applied by the bushing studs. High voltage cover bushings are held internally by a keeper plate and spring arrangement.

This is just one of the many very good reasons why Allis-Chalmers distribution transformers assure outstanding performance for many years. For all the "good reasons," call your A-C man, or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

A-C ALLIS-CHALMERS

ALLIS-CHALMERS

A-5718

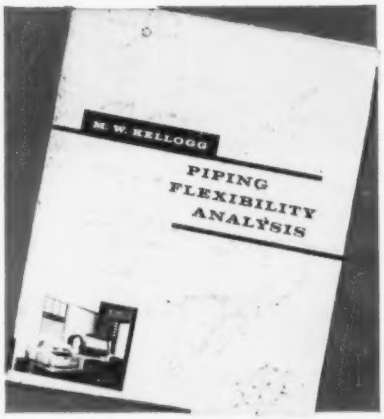
KELLOGG'S PIPE SHOP FABRICATION KEEPS PACE

This complex header for the hot reheat line, here being finished at M. W. Kellogg's Jersey City shops, is an important part of the power piping for Alabama Power Company's Unit No. 3 at Barry, Alabama. This modern steam-electric plant addition in Mobile County is designed for operation at 2000 psi and 1000°F initial temperature; 1000°F reheat. The turbine will supply 225,000 KW.

All power piping for the unit is being fabricated and erected by Kellogg, who will also furnish and install all hangers, guides, anchors, supports, and similar equipment. K-Weld®, Kellogg's unique, inert gas-shielded arc welding technique, is being used on the main steam line and hot reheat lines, and was used in fabricating the header shown above.

Dimensions of the critical steam lines being fabricated of 1¼ Cr., ½ Moly. in Kellogg's Jersey City shops are: *Main Steam*—17.5″ O.D. x 2.25″ minimum wall, and 12.75″ O.D. x 1.6875″ minimum wall; *Hot Reheat*—26″ O.D. x 1.24″ minimum wall, and 16″ O.D. x 0.8025″ minimum wall.

Kellogg welcomes the opportunity to discuss its complete power piping design, fabrication, and erection facilities with consulting engineers, engineers of power generating companies, and manufacturers of boilers, turbines, and allied equipment.



This new 8-page booklet, fully describing Kellogg's electronic computer method of making piping flexibility analysis, has just been published. Write for a copy.

Fabricated Products Sales Division

THE M. W. KELLOGG COMPANY, 711 THIRD AVENUE, NEW YORK 17, N. Y.

A SUBSIDIARY OF PULLMAN INCORPORATED

The Canadian Kellogg Co., Ltd., Toronto • Kellogg International Corp., London • Kellogg Pan American Corp., New York
Societe Kellogg, Paris • Companhia Kellogg Brasileira, Rio de Janeiro • Compania Kellogg de Venezuela, Caracas

POWER PIPING—THE VITAL LINK

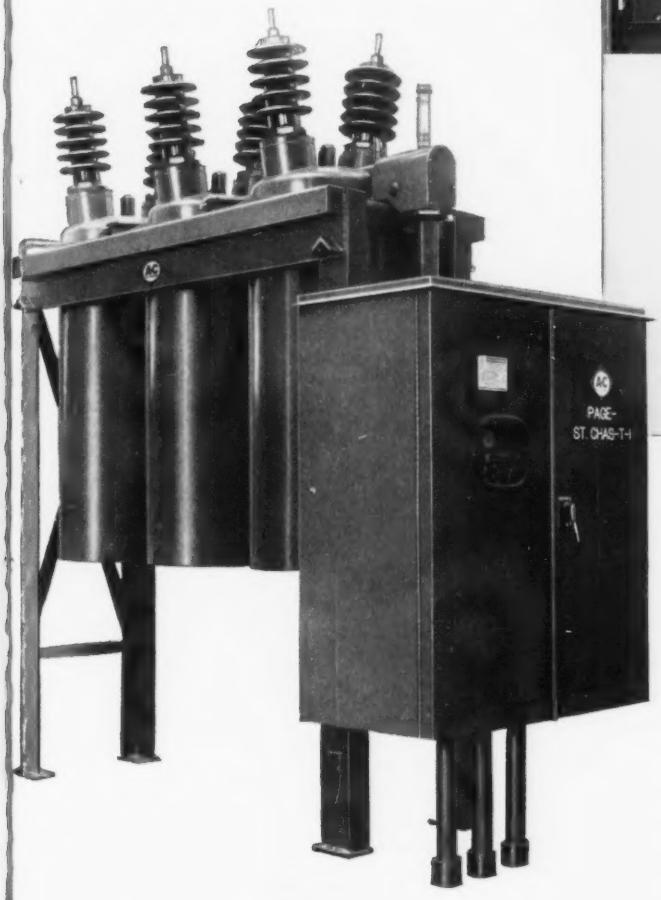
® *Registered trademark of The M. W. Kellogg Company*

for
reliability

for ease
of maintenance

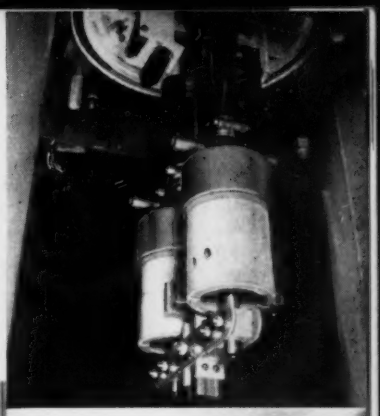
for ease
of operation

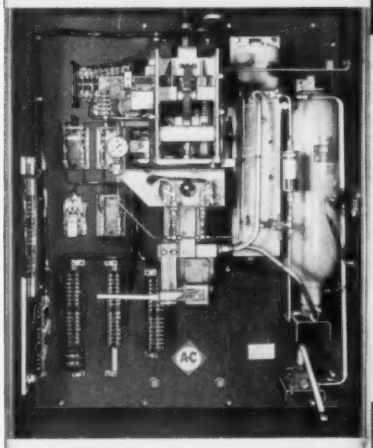
...3 top breaker features



1

Fast contact opening and closing proved by time and laboratory tests. *Turbo Ruptor* device features bayonet and segmented tulip for wiping action, positive contact and absorption of mechanical impact.



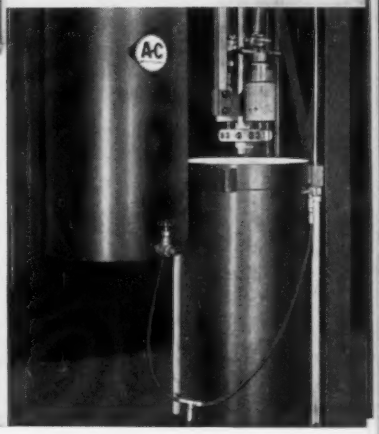


2

Simple design, with few moving parts . . . the *Pneu-Draulic* operator offers many advantages. Dust, dirt, moisture, heat and cold are no problems. Field-proved in dozens of utilities.

3

Full access to tanks and contacts unobstructed by framework. In addition, optional power-operated hydraulic tank lifter eliminates hand cranking, makes it safe and easy to lower and raise tanks.



Allis-Chalmers large frame-type breakers have many quality features

Careful attention was given to every detail of design and construction. The result: today's top breaker value!

In addition to the features pictured above, you'll find self-cleaning, smooth, fabricated steel tops for each tank; ball-type position indicator visible from greater distances; float-type oil gauge that eliminates leakage; full tank skirt for added stability when tank is on ground.

For details, contact your nearby A-C office or write for Bulletin 71B8475. Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

A-C ALLIS-CHALMERS

A-5672

ALLIS-CHALMERS

Pneu-Draulic and *Turbo Ruptor* are Allis-Chalmers trademarks.

When you consider expansion . . . the most important investment you can make is in the creative ability of men.

FLUOR

Engineers and Constructors

Design in three dimensions

At Fluor's Los Angeles headquarters, there is an 8,000-square-foot building where 30 plant designers work with 20 professional modelmakers. Drafting tables are within 10 feet of model assembly tables. Another building contains an elaborate photographic studio where precisely scaled isometric and plan views can be taken under shadowless lighting.

All this began seven years ago when Fluor engineers built a scale model and rigged miniature hoists to solve a difficult erection problem. Success of this trial led to experiments with the use of models as a basic design tool. Cost studies showed substantial savings in drafting man-hours (net savings, above modelmaking costs.)

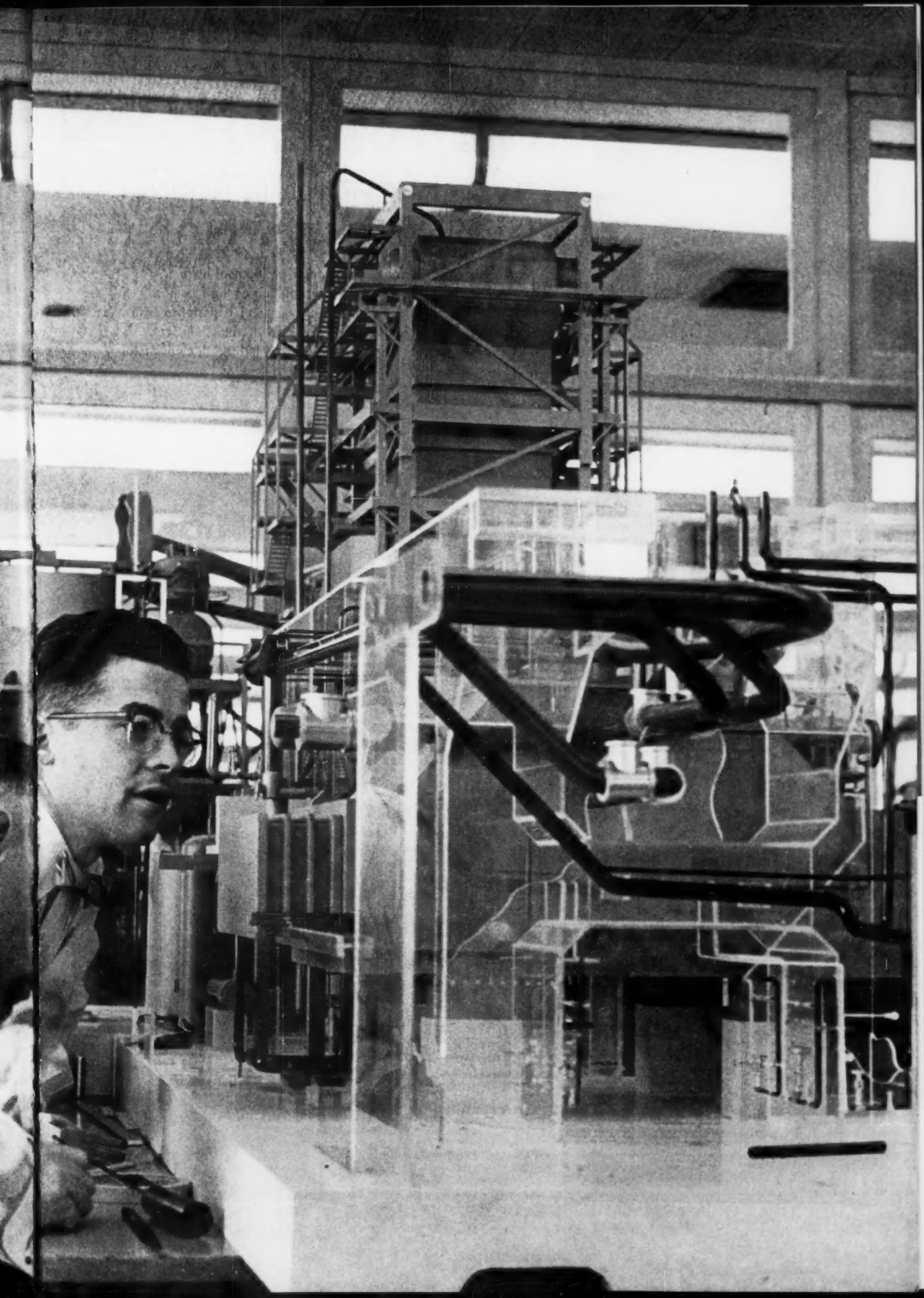
Today, models are to be found in most of Fluor's drafting rooms, and nearly all Fluor-built plants are designed with the aid of this tool. Beyond the dollar savings there are many less tangible benefits. Sizable groups can confer over a model, reach quick agreement on layouts, approve or revise many details at a single session.

Piping runs are shorter and more direct, valves and instruments are more accessible when designers lay them out on a model (a Fluor comparison study of a refinery design showed a $50,000 saving in pipe, fittings and fabrication by use of a model vs. conventional layout drawings.)

Costly revisions are minimized when many specialists can study a complete plant in miniature before construction begins. In the field, models serve as a reference for construction crews and a guide for operator training.

Unless scale models are properly used—as a basic, integrated design tool—most of these advantages are lost. The development and refinement by Fluor of design techniques using scale models has been a creative contribution to the engineering and construction industry.

For more information on the use of scale models in design and construction, write to Dept. 65, The Fluor Corporation, Ltd., 2500 South Atlantic Boulevard, Los Angeles 22, California.



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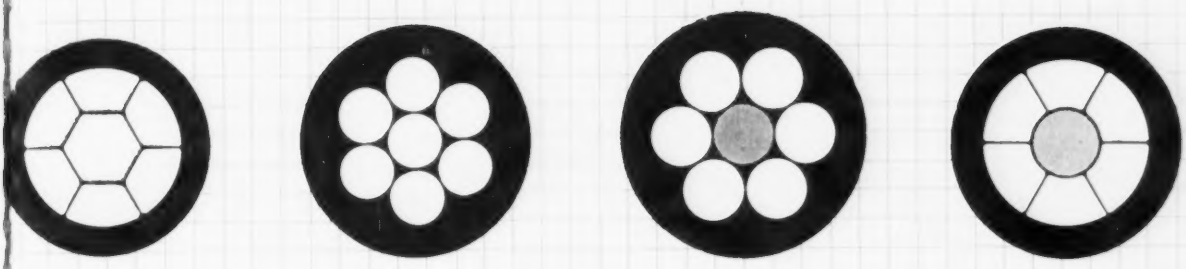

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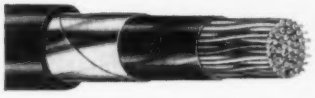

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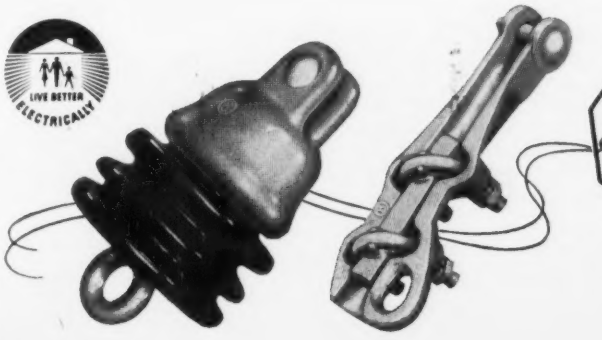

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Editorial Comment

FEBRUARY 23, 1959

Why They Call It "Recession Proof"

The electric utility industry did itself proud in 1958 and proved its right to be called "recession proof." Beginning on page 83 of this issue, you will find a complete statement of the industry's performance during recession ridden 1958. You will find, for instance, that:

• Total electric energy sales (page 84) increased 2.1% in the face of a 2.6% drop in industrial load (traditionally 50% of the total). And even this 2.6% drop in industrial isn't too hard to take if you consider total industrial production dropped 6.3% from its 1957 high. So while this is the smallest yearly gain in the past twelve it illustrates the inherent stability of the industry.

• Electric revenue growth made an even better showing rising 4.8% to $9.7 billion (page 86). As with load, residential and commercial revenues were responsible for this outstanding performance. Residential revenues (41% of the total) jumped 7.1% to $4.0 billion while commercial (25% of the total) climbed 5.9% to $2.4 billion.

But aside from setting new sales and revenue records in 1958 the industry continued to make substantial progress in other areas. It did, for instance:

• Increase installed generating capacity (page 89) by 13.3 million kw putting the year-end total at 142.4 million kw.

• Affected economies in operation by reducing the coal rate (page 98) to 0.91 lb of coal for each kwhr produced.

With performance such as this, electric utilities will continue to play an increasingly important role in a growing America—offering a stabilizing influence to the economy and a defensive shelter for the harried investor.

We're Behind You 100%, Mr. Gadsby

In his latest interim report to stockholders of Utah Power & Light Co, Chairman of the Board George M. Gadsby suggests that there's always room for one more in the "Something-of-the-Month" trend in recent years. We have books, records, and even foodstuffs. "It's time now for the taxpayers to endorse a 'Congressional Savings of the Month Club,'" he says. Membership would be conferred upon those Congressmen and Senators who dare pare the fat from pork barrel projects, who see that government funds spent on nongovernment activities and services are repaid in full, and who stipulate that funds advanced for local purposes are repaid to the Treasury. As Mr. Gadsby points out, the "opportunities are legion."

He continues: "Perhaps your Congressional representatives in both houses will appreciate knowing—each month if need be—that you are recommending them for membership in the club and applauding them for passing on to you the tax saving benefits of their actions—or vice versa."

Pardon us now while we search for candidates.

Eisenhower

- President, at NRECA meeting, says most co-ops can afford going cost of money
- Johnson, Rayburn, Kennedy say 2% interest rate will not be raised
- Ellis outlines PR and national trust fund programs

President Eisenhower told some 7,000 officers, directors, managers and members of America's rural electric cooperatives to stop seeking favored financial treatment—specifically 2% money—from the federal Treasury, and to become stronger and more self-sufficient. He made his remarks before the 17th annual meeting of the National Rural Electric Cooperative Assn, held in Washington, Feb. 9-12, during National Electrical Week.

The President, in an unscheduled 10-minute address before the huge conclave (the second largest trade meeting in Washington's history, according to NRECA President Walter Harrison), said: "America at this very moment is engaged in a great debate on the role of government in the lives of her citizens. A part of this debate revolves around the question: Shall government live within its means; shall our citizens, in a prosperous time, meet the cost of the service they desire of their government?

"Or is it to be the established policy of our government to follow the ruinous route of deficit financing, of inflation, of taxes ever rising, until all initiative and self-reliant enterprise are destroyed? This route, I remind you, is one that would surely torpedo all the great achievements of your organizations in the past quarter century."

Digs at 'Demagoguery'

Then he drove home the Administration's principal point:

"Now I come to the one point on which I realize full well there is some disagreement. Parenthetically, I feel obliged to say I believe we are not going to find a decent solution to any of these differences —or to any of the other serious problems facing our country—by resort to demagoguery that seeks support for a special position.

"One difference of which I speak is the rate of interest paid by persons and agencies who borrow from the federal Treasury. Specifically I refer to programs—such as REA and college housing—in which borrowers do not pay interest rates equal to the cost of money to the government, but are capable of doing so.

"I have recommended that the Congress authorize the Treasury to set these rates at a level that will recover the cost of money loaned . . . I do not intend, nor does this Administration believe, that these future interest rate changes would be harmful in any way, nor can they be, to your systems."

The main Eisenhower contention is that REA and the co-ops are no longer "infant enterprises," and that they can afford and should pay the going rate for money. Otherwise, the President argues, the co-ops will turn public opinion against

ELLIS JOHNSON RAYBURN KENNEDY

Tells Co-ops: 'Become Self-Sufficient'

them, and as a result, the entire program will be jeapordized.

The White House views were echoed, to no one's surprise, by REA Administrator David Hamil. Hamil ticked off a number of facts that, he said, "spell a tremendous challenge and opportunity" for co-operatives:

- Rural electrification is going to get bigger, both in number of consumers and power use, largely because of the exodus from the towns and cities.
- Rural electric utilities "can no longer be identified as farm utilities." He noted that REA borrowers are now selling slightly more power to non-farm customers than they are selling to farmers.
- REA borrowers will require large amounts of capital in future years.
- Rural electric cooperatives have made important gains in financial strength. Average net worth of REA electric borrowers reached 16.4% of assets by the end of 1958, and "is likely to keep on increasing at the rate of about 2% a year."
- Finally, rural electric co-ops have proved themselves "reliable and efficient distributors of electric power."

Suggests Policy Revisions

In the light of these facts, Hamil suggested the co-ops revise their policies, procedures, and attitudes "to make sure they are geared to a rapidly expanding economy." He further suggested that they re-examine their position in relation to the general public and the federal government. "The day will come," he said, "when the public will ask you to pay an interest rate more in line with the cost of money to the government. Without getting into a debate over whether you are partially subsidized or not, I think you will agree that you are presently borrowing money at a bargain-basement rate of interest. As pressures on the federal budget increase, taxpayers may ask all beneficiaries of federal credit programs to stand on their own feet if they possibly can. Also, I think it would be dangerous for you to assume that the Rural Electrification Act includes a lifetime of federal financing. This is another area that requires careful reappraisal. It is the American tradition that the day will come when you will be asked to obtain at least a portion of your financing from a source other than the federal Treasury. It would be wise to start thinking and planning now so that you won't get caught flatfooted."

But if Eisenhower and Hamil hit hard on the cheap-money issue, the co-ops were not without friends on it and other matters on which power-industry men of all shades of opinion have been focusing their attention.

Johnson: 'Fight With Beer Bottles'

Senate Majority Leader Lyndon Johnson, substituting for snowbound Hubert Humphrey, told the co-ops to "fight with beer bottles, if necessary" to preserve their systems. Johnson, evidently with one eye on the co-ops and the other on the 1960 presidential elections, delivered a lively, impassioned political oratorio in which he said Congress will do three things:

1. It will not raise the 2% interest rate.

2. It will not require "you to go down the Wall Street chute" for funds.

3. It will pass the Humphrey-Price bill, returning to the REA Administrator the right to pass on loan requests, regardless of size.

House Speaker Sam Rayburn, one of the authors of the REA Act, received a plaque from NRECA and its members acknowledging and thanking him for his services for rural electrification. Rayburn, disclaiming both "beer bottles and dead cats", also told the group that Con-

(*Continued on p* 152)

Highlights of NRECA Resolutions

Fifty-two resolutions passed the voting delegates of the 17th annual meeting of the National Rural Electric Cooperative Assn. Here's a brief rundown on some of the more important ones.

RESOLVED to commend Rep J. L. Whitten for his House Resolution to investigate Comptroller General Joseph Campbell and to urge the House to pass it at an early date.

RESOLVED to urge Congress to oppose all proposals to increase REA interest rate or send co-ops to the private money market.

RESOLVED to urge Congress to pass the Humphrey-Price Bill.

RESOLVED to commend the FPC and IRS rulings with respect to power company advertising, and to urge Congress to introduce legislation supporting these rulings.

RESOLVED to urge Congress to institute a long-range study for protecting and using the nation's natural resources.

RESOLVED to endorse the Columbia River Development Corp.

RESOLVED to urge the REA Administrator to make G&T loans.

RESOLVED to support Corps of Engineers study for the Potomac River basin and the Passamaquoddy (Maine) Project.

RESOLVED to urge the Congress to pass the Gore bill calling for $1 billion A-plant program, and to allow co-ops to participate in the development of atomic power.

RESOLVED to support preference principle on all rivers and harbors.

RESOLVED to support the TVA self-financing bond plan.

RESOLVED to urge Congress to build necessary transmission grid and thermal power to firm the hydro potential in the Missouri River basin, and to sell such power to preference customers.

RESOLVED to urge Congress to pass H.R. 3142, to make transmission lines common carriers to the extent of their excess capacity.

TORNADO tore up St. Louis street, left, killed at least 21. Icy highway near Muskegon, Mich., above, led to the death of two Consumers Power Co line crewmen in truck

Storms, Floods Harass Utilities Again

For the second time within a month, widespread storms, ice, tornados and floods put electric utilities in the Midwest and North Central regions on guard. Damage was minor, with a few exceptions.

Union Electric Co faced the biggest repair job, mostly on distribution feeders and secondaries whiplashed by a tornado Feb. 10. At the peak, 50,000 customers were blacked out. Restoration on virtually all of these was accomplished within 24 hr. The quick recovery was aided by an emergency plan.

The UE plan takes a page from "get-out-the-vote" schemes which aim for a chain reaction of phone calls. The home office contacts two employees who each call two more workers; these, in turn, each call two more, and so on.

The tornado path was only two blocks away from the Chase Hotel, where the Utility Buyers conference was being held.

The rampaging Salamonie and Wabash rivers caused some damage on Public Service Co of Indiana's system. A service center at Wabash was flooded. For a while there appeared to be a definite threat to the company's Wabash River Plant at Terre Haute, but flood waters were checked in time by sandbagging.

Southern Indiana Gas & Electric Co at Evansville had only the "minor run of trouble."

The electric system of Northern Indiana Public Service Co was unaffected, but flood conditions inflicted minor damage on gas properties. As with PS of Indiana, NIPSCO had some trouble in the eastern part of the state due to icing and snowdrifts several weeks ago.

Ohio Power Co was hit again, lightly this time, by floods. The company did not lose any production or transmission facilities; distribution problems were nominal. Damage estimate was $15,000 compared with $100,000 for the mid-January flood.

Wisconsin Power & Light Co reported heavy snows "slowed us down some," but caused no outages or damage. Consumers Power Co in Jackson, Mich., said it was unaffected by the bad weather.

So Cal Ed's Harry Lott Wins Last Hatfield Pool

The winner of the 1958 Hatfield Pool of power generation forecasts is Harry A. Lott, manager-power supply services for Southern California Edison Co (below left).

Lott's estimate of total kwhr output of the nation's electric utilities was closest among this year's 510 participants—and among the closest to actual output in the pool's 13-year history. His guess of 644,822,000,000 kwhr missed the actual figure by less than 1/100th of 1%. The actual was 644,760,148,000.

Runner up was Sam Bowler of Edward Valves, Inc, who won the pool in 1948. Bowler came within an ace of repeating in '58 with a guess of 644,644,000,000 kwhr.

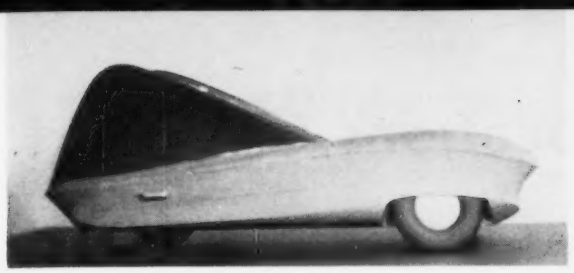
Harry Rankin, of General Public Utilities Corp, was third. He was followed by G. R. Guthrie, of Indianapolis Power & Light Co.

The pool's founder, Robert M. Hatfield, vice president of Combustion Engineering, Inc, has announced reluctantly that this marks the end of the annual power generation pool. Electrical World was to have taken it on, but cannot, owing to technical considerations.

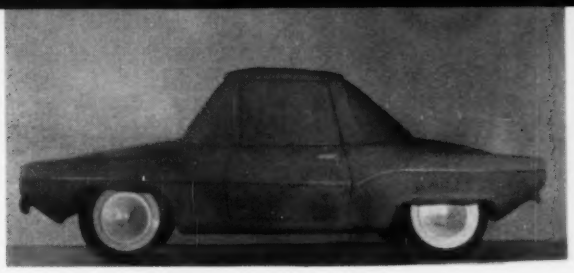
Hatfield started the pool in 1946, among a handful of men who had worked with him in the Office of War Utilities during World War II.

"The word got around," Hatfield explains. "Lots of the OWU crowd sent in their guesses, and in time the pool came to be a nice directory of the crowd who worked together and knew each other during the war."

An idea of the industry's progress since then comes from the report of the first Hatfield Pool, won by the late George Merritt of Westinghouse. His guess: 223,367,000,000 kwhr.



FIRST PRIZE—James Belknap



SECOND—Toby Thompson

THIRD—Richard Chapman

THIRD—Richard Chapman

Electric's Future Design Previewed

Syracuse University competition aims for runabout that fits range of suburban application

Syracuse University has taken its first step in fostering designs specifically drawn for an electric runabout. The school's industrial design department selected winners in a competition seeking a "unique" form.

In setting up the problem, the department's professor in charge, Arthur J. Pulos, gave students a briefing on the electric's origins, its demise after the self-starter was developed in 1912 for gasoline vehicles, then offered reasons why "once again, the concept of an electric runabout begins to offer promise. . ."

The promise exists, he says, because of growing demands for transportation at lower cost and greater mobility, and U. S. car makers' production of "Juggernauts."

There is a market in the U. S. for the runabout developed as a second car for local suburban use, and there's a possibility of export value of such a car, Prof Pulos maintains.

He is interested in seeing the school's project go further. "Should one of the major battery companies or an electric utility be interested in sponsoring a project to build such a vehicle, or the body for such a vehicle on this campus, we would be pleased to set up a project to do so," he told EW.

DESIGN PRIZE is given to Belknap by J. H. Lewis, vp, Lewis-Shepard: Others (l to r) Dr L. Schmeckebier and Pulos

Models shown here were designed for two adults and two children plus 100 lb of groceries. Electric system was 24 to 48 v at 160 to 300 amp. Specifications included: driving range of 50 to 80 mi; time range, 4 hr; speed, 35 to 60 mph; weight 1,990 lb. Cost schedule called for $2,500 max purchase price plus $150 for an automatic recharger. Total yearly expense was set at $163, including $50 for recharging.

RUNNER-UP—James Muir

RUNNER-UP—Robert Uranken

Missouri Valley Allocations Criticized

Co-op, municipal system witnesses dislike U.S.B.R.'s method of allocating future hydro capacity. They urge that existing capacity be firmed up with steam or nuclear plants

A score of witnesses from cooperative and municipal power systems descended on the Senate Interior Committee last week to testify against the Bureau of Reclamation's method of allocating 1,565,000 kw of new hydro power capacity, coming on the line from federal, mainstem Missouri River dams by 1965.

Most of the witnesses—many still in Washington from the just-ended annual convention of the National Rural Electric Cooperative Association—also testified in favor of Sen. James Murray's (D-Mont.) resolution (S. Res. 71) calling for a nationwide study of power transmission facilities (EW, Feb. 16, p 64).

Criticism centered on three points:

- The bureau will be able to meet only 85% of preference customer power needs in 1963, 70% in 1965, because only 990,000 kw of the 1,565,000 kw available can be sold as firm power. The remaining 575,000 kw would be sold on an interruptible basis at dump rates, probably to private companies.

No Wheeling Involved

- If preference customers contracted with the bureau to wheel additional power supplies to them from other nearby sources, the bureau would charge wheeling fees, although witnesses claimed no "wheeling" would be involved—only "displacement" of federal power. One purpose of a wheeling fee is to cover transmission losses over long distances, they pointed out, and this does not always apply. Either the bureau should "reappraise" its wheeling policy, witnesses claimed, or Congress should correct the situation.
- Reclamation allocated power to co-ops at the Dec. 9-10 meeting in Sioux Falls, S. D., on the basis of power applications without considering individual load requirements, previous contracts with the bureau or other sources of power delivery. This, they claimed, worked out unfairly for many preference customers.

Preference customer spokesmen called for immediate action to firm up the bureau's remaining 575,000-kw power capacity on the Missouri River Dams by several methods: build federal steam or nuclear generating plants to back up hydro capacity; integrate the Missouri River hydro system with existing steam plants; prevent the Army Engineers from releasing large blocks of water from these power dams for river navigation—this water could be stored to increase firm power deliveries at Fort Peck, Oahe, Big Bend, etc.; construct large federal power transmission grids to bring in more power, including construction of the Curecanti unit (159,000 kw) of the upper Colorado project.

Sen. John Carroll (D-Colo.) questioned whether the 575,000 kw of dump power, sold at reduced rates to private companies in the area, was giving those companies an unfair advantage in the allocation of Missouri River power.

Assistant Interior Secretary Fred G. Aandahl will answer co-op complaints at a March 5 hearing before the same committee.

Joint Plan Backed on BPA Tie

California Gov Edmund G. Brown has joined the growing controversy over a possible interregional power tie from the Federal Columbia River system to California. He launched his state into the fray by letters to Washington and Oregon governors, urging them to unite with him to study the problem and develop a joint "long-range power intertie program."

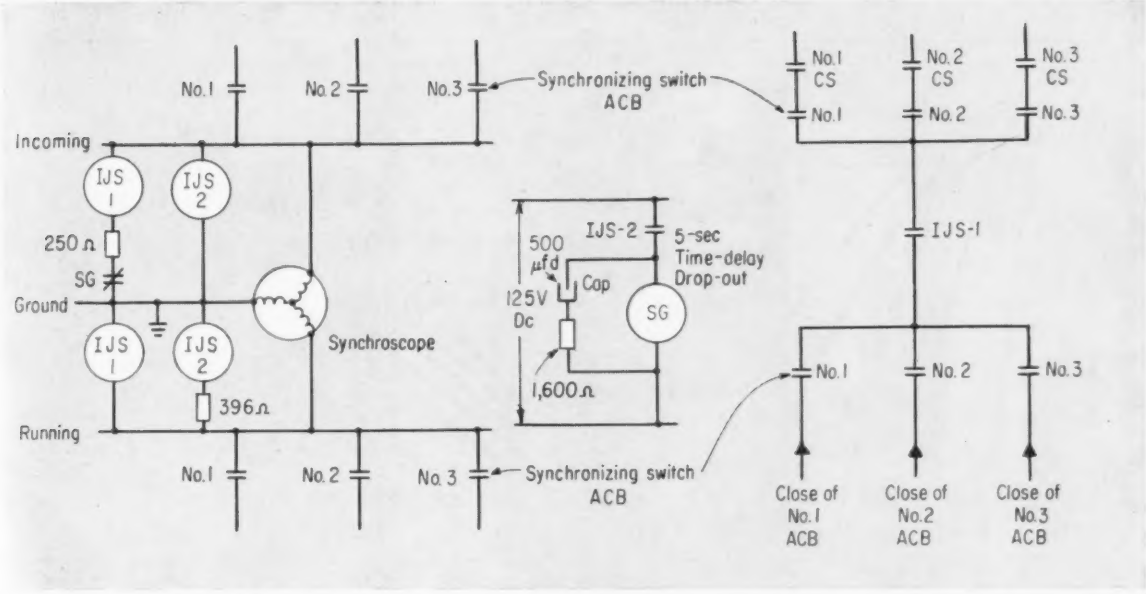
Brown referred to surpluses of "nonfirm interruptible" energy available during several months of the run-off season in most years, and for which BPA is seeking a market. The amount of power being wasted under median conditions has been cited variously as 3 to 12-billion kwhr a year.

Washington Gov Rossellini sees little merit in the plan. "I don't know of anything that we would be in a position to sell or give away," he said Feb. 10. He promised consideration of Brown's plan, but added that his state consistently has been seeking additional generation.

The California governor noted "reports that BPA faced deficits and resulting possible need to raise rates unless a market for the power can be found." California can use the power for water pumping in its statewide water program, he said, but he urged his fellow chief executives not to limit their approach to this. "We . . . should not accept any short-range program, because increasing population will require more and more industries to furnish jobs—and industries can be attracted to the West if power rates are kept low."

Brown's reference to "short-range programs" may have been a poke at current BPA-Pacific Gas & Electric Co negotiations which would permit PG&E to obtain some excess power, with California Oregon Power Co, a third party, wheeling the energy across the 145-mi gap between the two big systems (EW, Feb. 2, p 35).

A few weeks ago a third study group, made up of public power agencies in the three states, was formed. The 12-member Pacific Coast Power Coordinating Committee, which includes California representation, is believed to be studying an extra-high-voltage circuit stretching from the heart of the BPA system to "somewhere south of Shasta Dam." The proposed $50-million line would put the public power groups in the common carrier business.



Relay Scheme Checks Synchronism

WILLIAM TURNER, Relay Engineer, Pennsylvania Electric Co, Johnstown, Pa.

Proper synchronizing of a machine with the system is assured through use of a synchronizing-check relay scheme devised by Pennsylvania Electric Co. This scheme, for machines with non-automatic means of synchronization, is a check on the operator when he is bringing a machine on the line.

It will prevent the closing-in of a machine that is too far out of phase for proper synchronizing, or is being brought on the line too fast or too slowly. The scheme was deemed necessary after an operator, believing he was operating the governor switch, mistakenly turned the breaker control switch and closed-in a machine not in synchronism.

This scheme is applicable only on generators that have stable governor control. Components include two synchronizing check relays (type IJS), a 5-sec time-delay drop-out relay, one capacitor, and three resistors. Use of a relay other than type IJS was not investigated for this application. As shown in the illustration, one relay is designated IJS-1 and the other IJS-2. The synchronizing switch for this scheme must have two separate contacts for proper isolation of the IJS-1 contacts.

Time-dial settings on the IJS-2 relay should be set at 0.4 lever and on the IJS-1 at 0.5 or 0.6 lever. This lever difference is of value in a condition where the synchroscope hand is traveling counterclockwise (slow machine) at a constant speed. It insures that any relay "pickup" occurs first in IJS-2, thus blocking IJS-1 and preventing possible closing of the generator breaker as the generator is moving away from synchronism.

External resistors and resistors in relay IJS-1 are adjusted, using a test synchroscope and phase-shifter, to swing the characteristic in a counterclockwise direction so that it unequally straddles the position of perfect synchronism. In the same way, the characteristic of IJS-2 is adjusted so that the entire band width is located clockwise to perfect synchronism. Rotation of these characteristics provides sufficient band width of closing torque so that IJS-1 contacts normally will close slightly before the operator attempts to close the generator breaker through the control switch.

If the machine coming on the line is causing the synchroscope hand to move very slowly in the fast direction relative to the system, IJS-1 contacts will begin to close about 25 deg ahead of perfect synchronism. If the machine is moving too fast, IJS-1 contacts will not close due to insufficient torque and time.

The action of IJS-2 is to prevent the bringing-in of a "slow" machine. Torque on this relay will close its contacts and energize the time-delay relay, which will block IJS-1 and prevent possible closing of the main breakers. The shunting resistor and capacitance seal in this time-delay drop-out relay for 5 sec. Operators have been instructed to come in only with a "fast" generator.

Chart Aids in Application of Shunt Capacitors

R. A. **DEWBERRY**, Electrical Engineer, Montana-Dakota Utilities Co, Minneapolis, Minn.

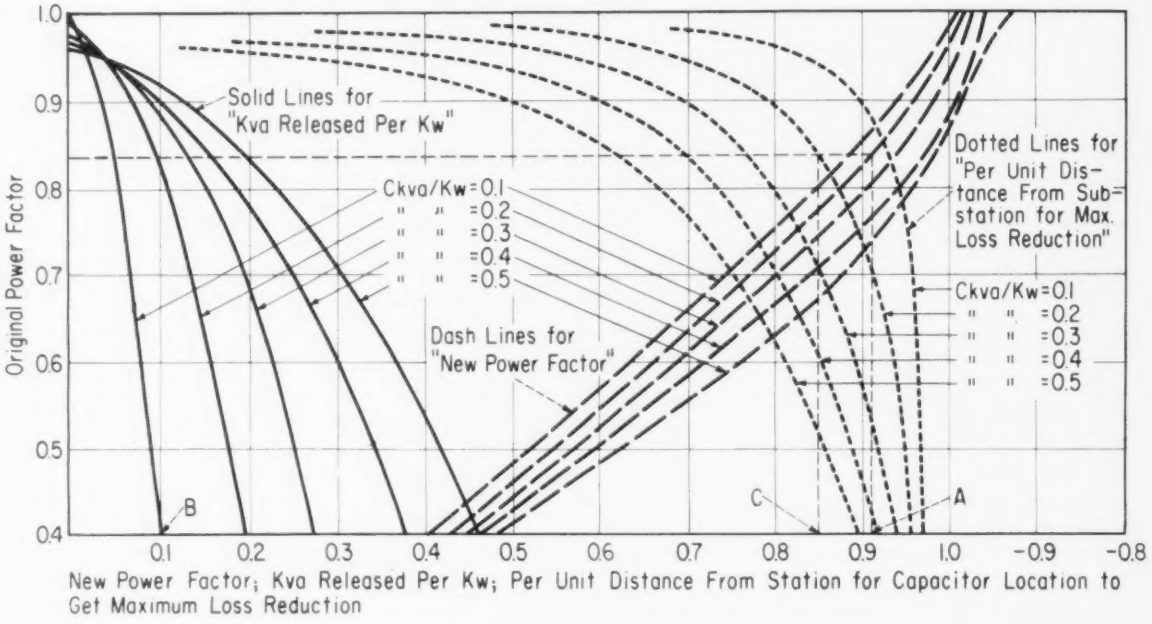


Chart provides a group of curves to facilitate application of shunt capacitors particularly on distribution circuits. Curves are plotted on the basis of three functions—Equations (1), (2), and (3) for the new power factor, the kva released per kw, and the most economical location, respectively, in terms of the original power factor and the ratio ckva/kw.

New power factor is:

$$PF_2 = \cos [\tan^{-1} (\tan \theta_1 - Ckva/Kw] \quad (1)$$

Kva released per kw is:

$$\Delta Kva/Kw = \sec \theta_1 - \sec [\tan^{-1} (\tan \theta_1 - Ckva/Kw)]$$

Neagle and Samson* have shown that, on a uniformly loaded feeder, the least power loss will occur when shunt capacitors are located so that their per unit (PU) distance from the source is:

$$PU\ Distance = 1 - Ckva/2Kvar$$

If $Kw/\cot \theta_1$ is substituted for Kvar:

$$PU\ Distance = 1 - (Ckva/2\ Kw \times \cot \theta_1) \quad (3)$$

Example for use of chart

PROBLEM. A uniformly loaded feeder is two miles long and supplies a load of 1,500 kw at 0.84 power factor. If 300 kva of capacitors are installed:

(A) What will be the new power factor?

(B) What kva will be released?

(C) Where should the capacitors be located to get the least line loss?

SOLUTION

$$Ckva/Kw = 300/1500 = 0.2$$

(A) Follow the 0.84 power factor line horizontally until it intersects the "dash" curve for 0.2 ckva of capacitors per kw of load and on the scale at the bottom of the chart, read the new power factor as 0.91.

(B) Follow the 0.84 power factor line horizontally to the "solid" curve representing 0.2 ckva of capacitors per kw of load, then project down to the scale at the bottom of the chart and read the kva released per kw is 0.1, or a total of $0.1 \times 1,500 = 150$ kva.

(C) Follow the 0.84 power factor line to the "dotted" curve for 0.2 ckva of capacitors per kw of load, then project down to the scale at the bottom of the chart and read the location of capacitors should be at 0.85 per unit from the substation, or a distance of 0.85×2 miles $= 1.70$ miles from the station.

Basic Terms

θ = power-factor angle; kw/kva

PF = power-factor

Kw = kilowatts (active power) of circuit at a power factor

Kva = kilovolt-amperes (apparent power) of circuit

Kvar = kilovolt-amperes reactive

Ckva = capacitor kilovolt-amperes

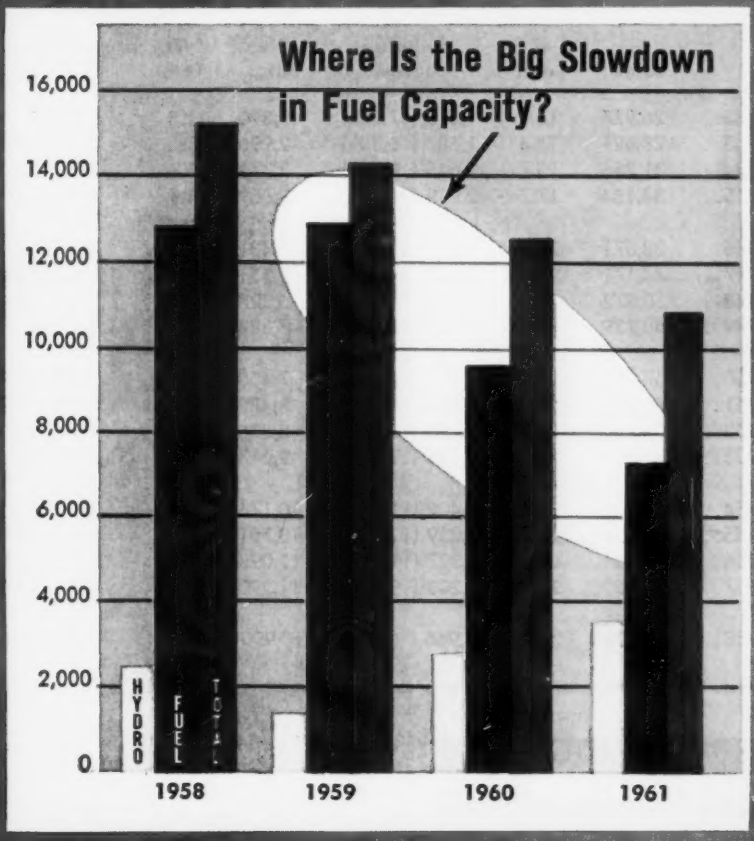
Note: Subscript 1 indicates the term is for a condition at original power factor, thus kva_1 and pf_1. Subscript 2 indicates the term is for a condition after capacitor has been applied and for resultant power factor, thus kva_2 and pf_2.

*See AIEE Transactions—Power Apparatus and Systems, Oct. 1956, pp 950-959.

ELECTRICAL WORLD INDUSTRY STATISTICS

55th Annual Report

Planned Capacity Additions—Megawatts



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Capacity Additions Reported to EW ..... p 101

Arthur J. Stegeman Manager, Market Research

This is Part II of Electrical World's 55th Annual Statistical Report on the electrical industry. Part I, containing utility construction budgets for 1959, was published January 26.

While Part II is primarily a statement of industry health as of January 1, 1959, it also provides a far-reaching insight into specific utility plans (p 101) as indicated in the chart above.

On other pages of this report you will find:

- Total energy sales in 1958 up 2.1% over 1957 despite a 2.6% drop in industrial sales.
- Average residential use up 203 kwhr to 3,377 kwhr during 1958.
- Electric customers increased 1,039 thousand this past year upping the total to 56.2 million.
- Electric revenues up 4.8% to $9.7 billion.

Sales

Residential and Commercial Sales Boost Total

(Millions of kwhr)

	Residential			Rural*			Small Light & Power		
	Sales	% Total	Annual Change	Sales	% Total	Annual Change	Sales	% Total	Annual Change
1942..	26,937	16.9	1,813 (7.2%)	2,890	1.8	538 (22.9%)	27,233	17.1	2,605 (10.6%)
1943..	28,621	15.4	1,684 (6.3%)	2,996	1.6	106 (3.7%)	28,192	15.2	959 (3.5%)
1944..	31,266	15.7	2,645 (9.2%)	3,373	1.7	377 (12.6%)	29,837	15.1	1,645 (5.8%)
1945..	34,184	17.7	2,918 (9.3%)	3,669	1.9	296 (8.8%)	30,438	15.7	601 (2.0%)
1946..	38,571	20.2	4,387 (12.8%)	4,431	2.3	762 (20.8%)	33,016	17.3	2,578 (8.5%)
1947..	44,171	20.3	5,600 (14.5%)	5,551	2.5	1,120 (25.3%)	38,379	17.6	5,363 (16.2%)
1948..	50,978	21.2	6,807 (15.4%)	6,327	2.6	776 (14.0%)	43,193	17.9	4,814 (12.5%)
1949..	58,139	23.4	7,161 (14.0%)	7,384	3.0	1,057 (16.7%)	46,262	18.6	3,069 (7.1%)
1950..	67,030	23.9	8,891 (15.3%)	7,400	2.6	16 (0.2%)	50,446	18.0	4,184 (9.0%)
1951..	77,024	24.2	9,994 (14.9%)	8,479	2.7	1,079 (14.6%)	57,278	18.0	6,832 (13.5%)
1952..	86,780	25.3	9,756 (12.7%)	8,536	2.5	57 (0.7%)	62,080	18.1	4,802 (8.4%)
1953..	97,063	25.3	10,283 (11.8%)	9,613	2.5	1,077 (12.6%)	69,208	18.0	7,128 (11.5%)
1954..	108,465	26.4	11,402 (11.7%)	10,176	2.5	563 (5.9%)	73,373	17.9	4,165 (6.0%)
1955..	120,524	25.1	12,059 (11.1%)	10,751	2.2	575 (5.7%)	80,759	16.8	7,386 (10.1%)
1956	133,851	25.2	13,327 (11.1%)	11,098	2.1	347 (3.2%)	87,743	16.6	6,984 (8.6%)
1957..	147,059	26.4	13,208 (9.9%)	11,290	2.0	192 (1.7%)	95,142	17.1	7,399 (8.4%)
1958‡.	159,025	27.9	11,966 (8.1%)	10,990	1.9	—300 (2.7%)	101,265	17.8	6,123 (6.4%)

Source: Edison Electric Institute. * Sales on distinct rural rates. ‡ Estimated.

Average Use

Average Annual Residential Use

	Residential				Small Light
	Average Use		Average Bill		Average Use
	Kwhr	Change	per Kwhr	Annual	Kwhr	Change
1942.....	1,022	36 (3.7%)	3.67¢	$37.51	6,354	600 (10.4%)
1943.....	1,070	48 (4.7%)	3.60¢	$38.52	6,722	368 (5.8%)
1944.....	1,151	81 (7.6%)	3.51¢	$40.40	7,080	358 (5.3%)
1945.....	1,229	78 (6.8%)	3.41¢	$41.97	7,062	—18 (0.3%)
1946.....	1,329	100 (8.1%)	3.22¢	$42.79	7,224	162 (2.3%)
1947.....	1,438	109 (8.2%)	3.09¢	$44.43	7,915	691 (9.6%)
1948.....	1,563	125 (8.7%)	3.01¢	$47.05	8,535	620 (7.8%)
1949.....	1,684	121 (7.7%)	2.95¢	$49.68	8,871	336 (3.9%)
1950.....	1,830	146 (8.7%)	2.88¢	$52.70	9,320	449 (5.1%)
1951.....	2,004	174 (9.5%)	2.81¢	$56.31	10,432	1,112 (11.9%)
1952.....	2,169	165 (8.2%)	2.77¢	$60.08	11,106	674 (6.5%)
1953.....	2,346	177 (8.2%)	2.74¢	$64.28	12,007	901 (8.1%)
1954.....	2,549	203 (8.7%)	2.69¢	$68.57	12,353	346 (2.9%)
1955.....	2,751	202 (7.9%)	2.64¢	$72.63	13,422	1,069 (8.7%)
1956.....	2,969	218 (7.9%)	2.60¢	$77.19	14,395	973 (7.2%)
1957.....	3,174	205 (6.9%)	2.56¢	$81.25	15,432	1,037 (7.2%)
1958‡.....	3,377	203 (6.4%)	2.53¢	$85.44	16,185	753 (4.9%)

Source: Edison Electric Institute. ‡ Estimated.

2.1% Despite 2.6% Drop in Industrial Sales.

(Millions of kwhr)

	Large Light & Power			Other Classifications			Total	
	Sales	% Total	Annual Change	Sales	% Total	Annual Change	Sales	Annual Change
1942..	88,378	55.4	12,317 (16.2%)	13,969	8.8	2,074 (17.4%)	159,407	19,347 (13.8%)
1943..	106,657	57.4	18,279 (20.7%)	19,423	10.4	5,454 (3.9%)	185,889	26,482 (16.6%)
1944..	115,187	58.1	8,530 (8.0%)	18,497	9.3	−926 (4.8%)	198,160	12,271 (6.6%)
1945..	107,490	55.5	−7,697 (6.7%)	17,777	9.2	−720 (3.9%)	193,558	−4,602 (2.3%)
1946..	98,885	51.8	−8,605 (8.0%)	15,892	8.3	−1,885 (10.6%)	190,795	−2,763 (1.4%)
1947..	113,523	52.2	14,638 (14.8%)	15,957	7.3	65 (0.4%)	217,581	26,786 (14.0%)
1948..	124,088	51.6	10,565 (9.3%)	16,154	6.7	197 (1.2%)	240,740	23,159 (10.6%)
1949..	120,766	48.6	−3,322 (2.7%)	15,991	6.4	−163 (1.0%)	248,542	7,802 (3.2%)
1950..	139,065	49.5	18,299 (15.2%)	16,598	5.9	607 (3.8%)	280,539	31,997 (12.9%)
1951..	157,827	49.6	18,762 (13.5%)	17,560	5.5	962 (5.8%)	318,168	37,629 (13.4%)
1952..	167,358	48.9	9,531 (6.0%)	17,770	5.2	210 (1.2%)	342,524	24,356 (7.7%)
1953..	190,010	49.5	22,652 (13.5%)	18,350	4.8	580 (3.3%)	384,244	41,720 (12.2%)
1954..	200,155	48.7	10,145 (5.3%)	18,735	4.6	385 (2.1%)	410,904	26,660 (6.9%)
1955..	249,206	51.8	49,051 (24.5%)	19,681	4.1	946 (5.0%)	480,921	70,017 (17.0%)
1956..	276,647	52.2	27,441 (11.0%)	20,789	3.9	1,108 (5.6%)	530,128	49,207 (10.2%)
1957..	282,734	50.7	6,087 (2.2%)	21,604	3.9	815 (3.9%)	557,829	27,701 (5.2%)
1958‡.	275,300	48.3	−7,434 (2.6%)	22,870	4.0	1,266 (5.9%)	569,450	11,621 (2.1%)

Climbs to 3,377 Kwhr–Up 6.4%

d Power Average Bill		Total Ultimate Customers Average Use		Average Bill		
per Kwhr	Annual	Kwhr	Change	per Kwhr	Annual	
2.82¢	$179	4,980	445 (9.8%)	1.79¢	$98.14	 1942
2.74¢	$184	5,753	773 (15.5%)	1.66¢	$95.50	 1943
2.74¢	$194	6,047	294 (5.1%)	1.65¢	$99.78	 1944
2.79¢	$197	5,762	−285 (4.7%)	1.73¢	$99.68	 1945
2.80¢	$202	5,422	−340 (5.9%)	1.81¢	$98.14	 1946
2.69¢	$213	5,828	406 (7.5%)	1.77¢	$103.16	 1947
2.67¢	$228	6,073	245 (4.2%)	1.79¢	$108.71	 1948
2.66¢	$236	5,937	−136 (2.2%)	1.86¢	$110.43	 1949
2.64¢	$246	6,377	440 (7.4%)	1.81¢	$115.42	 1950
2.55¢	$266	6,922	545 (8.5%)	1.78¢	$123.21	 1951
2.55¢	$283	7,183	261 (3.8%)	1.79¢	$128.58	 1952
2.53¢	$304	7,815	632 (8.8%)	1.77¢	$138.33	 1953
2.52¢	$311	8,127	312 (4.0%)	1.77¢	$143.85	 1954
2.47¢	$332	9,265	1,138 (14.0%)	1.67¢	$154.73	 1955
2.45¢	$353	9,944	679 (7.3%)	1.64¢	$163.08	 1956
2.42¢	$373	10,214	270 (2.7%)	1.67¢	$170.57	 1957
2.41¢	$390	10,282	18 (0.2%)	1.71¢	$174.97	..... 1958‡

Customers

1.04 Million New Customers

	Residential			Rutal*			Small Light & Power		
	Customers	% Total	Annual Change	Customers	% Total	Annual Change	Customers	% Total	Annual Change
1942..	26,620,456	82.6	594,943 (2.3%)	1,095,512	3.4	108,793 (11.0%)	4,219,457	13.1	−80,519 (1.9%)
1943..	26,872,639	82.9	252,183 (0.9%)	1,088,698	3.4	−6,814 (0.6%)	4,168,245	12.8	−51,212 (1.2%)
1944..	27,371,260	82.8	498,621 (1.9%)	1,144,241	3.5	55,543 (5.1%)	4,263,395	12.9	95,150 (2.3%)
1945..	28,116,998	82.6	745,738 (2.7%)	1,234,441	3.6	90,200 (7.9%)	4,398,184	12.9	134,789 (3.2%)
1946..	29,769,107	82.3	1,652,109 (5.9%)	1,381,291	3.8	146,850 (11.9%)	4,692,850	13.0	294,666 (6.7%)
1947..	31,621,959	82.2	1,852,852 (6.2%)	1,522,136	4.0	140,845 (10.2%)	4,960,895	12.9	268,045 (5.7%)
1948..	33,549,396	82.4	1,927,437 (6.1%)	1,694,579	4.1	172,443 (11.3%)	5,131,730	12.6	170,835 (3.4%)
1949..	35,375,366	82.6	1,825,970 (5.4%)	1,804,415	4.2	109,836 (6.5%)	5,290,768	12.3	159,038 (3.1%)
1950..	37,532,549	83.4	2,157,183 (6.1%)	1,596,146	3.5	−208,269 (11.5%)	5,466,181	12.2	175,413 (3.3%)
1951..	39,224,621	83.8	1,692,072 (4.5%)	1,658,728	3.5	62,582 (3.9%)	5,528,117	11.8	61,936 (1.1%)
1952..	40,738,718	84.1	1,514,097 (3.9%)	1,663,201	3.4	4,473 (0.3%)	5,634,130	11.6	106,013 (1.9%)
1953..	41,981,633	84.1	1,242,915 (3.1%)	1,621,810	3.3	−41,391 (2.5%)	5,863,210	11.7	229,080 (4.1%)
1954..	43,139,998	84.2	1,158,365 (2.8%)	1,637,535	3.2	15,725 (1.0%)	5,991,586	11.7	128,376 (2.2%)
1955..	44,408,690	84.5	1,268,692 (2.9%)	1,648,398	3.1	10,863 (0.7%)	6,042,309	11.5	50,723 (0.8%)
1956..	45,711,460	84.7	1,302,770 (2.9%)	1,686,555	3.1	38,157 (2.3%)	6,124,745	11.3	82,436 (1.4%)
1957..	46,857,066	84.9	1,145,606 (2.5%)	1,635,227	3.0	−51,328 (3.0%)	6,186,701	11.2	61,956 (1.0%)
1958‡.	47,780,000	85.0	922,934 (2.0%)	1,630,000	2.9	− 5,227 (0.3%)	6,295,000	11.2	108,299 (1.8%)

Source: Edison Electric Institute. * Customers served under distinctly rural rates. ‡ Estimated.

Revenue

Residential Revenues Jump 7.1% to $4.0 Billion

(Thousands of Dollars)

	Residential			Rural*			Small Light & Power		
	Revenue	% Total	Annual Change	Revenue	% Total	Annual Change	Revenue	% Total	Annual Change
1942..	990,185	34.7	51,956 (5.5%)	75,027	2.6	10,631 (16.5%)	767,279	26.9	42,162 (5.8%)
1943..	1,029,260	33.4	39,075 (3.9%)	76,617	2.5	1,590 (2.1%)	773,678	25.2	6,399 (0.8%)
1944..	1,097,726	33.5	68,466 (6.7%)	82,842	2.5	6,225 (8.1%)	817,355	24.9	43,677 (5.6%)
1945..	1,167,356	34.9	69,630 (6.3%)	90,345	2.7	7,503 (9.1%)	850,213	25.4	32,858 (4.0%)
1946..	1,240,577	35.9	73,221 (6.3%)	104,876	3.0	14,531 (16.1%)	924,775	26.7	74,562 (8.8%)
1947..	1,366,498	35.5	125,921 (10.2%)	123,749	3.2	18,873 (18.0%)	1,031,335	26.8	106,560 (11.5%)
1948..	1,532,664	35.5	166,166 (12.2%)	140,648	3.3	16,899 (13.7%)	1,152,783	26.7	121,448 (11.8%)
1949..	1,716,533	37.2	183,869 (12.0%)	160,855	3.5	20,207 (14.4%)	1,228,726	26.6	75,943 (6.6%)
1950..	1,931,696	38.0	215,163 (12.5%)	157,611	3.1	−3,244 (2.0%)	1,333,755	26.2	105,029 (8.5%)
1951..	2,165,010	38.3	233,314 (12.1%)	175,431	3.1	17,820 (11.3%)	1,462,262	25.9	128,507 (9.6%)
1952..	2,400,889	39.1	235,879 (10.9%)	184,479	3.0	9,048 (5.2%)	1,584,219	25.8	121,957 (8.3%)
1953..	2,659,303	39.1	258,414 (10.7%)	201,691	3.0	17,212 (9.3%)	1,747,572	25.7	163,353 (10.3%)
1954..	2,920,196	40.1	260,893 (9.8%)	216,391	3.0	14,700 (7.3%)	1,846,634	25.4	99,062 (5.7%)
1955..	3,186,651	39.7	266,455 (9.1%)	228,815	2.9	12,424 (5.7%)	1,993,099	24.9	146,465 (7.9%)
1956..	3,476,719	40.0	290,068 (9.1%)	240,353	2.8	11,538 (5.0%)	2,147,085	24.7	153,986 (7.7%)
1957..	3,759,110	40.5	282,391 (8.1%)	242,457	2.6	2,104 (0.9%)	2,303,802	24.8	156,717 (7.3%)
1958‡.	4,025,000	41.3	265,890 (7.1%)	250,000	2.6	7,543 (3.1%)	2,440,000	25.1	136,198 (5.9%)

Source: Edison Electric Institute. * Revenue from sales under distinctly rural rates. ‡ Estimated.

Push Total to 56.2 Million.

	Large Light & Power			Other Classifications			Total	
	Customers	% Total	Annual Change	Customers	% Total	Annual Change	Customers	Annual Change
1942..	149,928	0.5	−22,749 (13.2%)	125,087	0.4	2,601 (2.1%)	32,210,440	603,069 (1.9%)
1943..	146,593	0.5	−3,335 (2.2%)	120,125	0.4	−4,962 (4.0%)	32,396,300	185,860 (0.6%)
1944..	151,652	0.4	5,059 (3.5%)	117,844	0.4	−2,281 (1.9%)	33,048,392	652,092 (2.0%)
1945..	162,338	0.5	10,686 (7.0%)	119,112	0.4	1,268 (1.1%)	34,031,073	982,681 (3.0%)
1946..	174,662	0.5	12,324 (7.6%)	122,381	0.3	3,269 (2.7%)	36,140,291	2,109,218 (6.2%)
1947..	191,363	0.5	16,701 (9.6%)	135,597	0.4	13,216 (10.8%)	38,431,950	2,291,659 (6.3%)
1948..	204,230	0.5	12,867 (6.7%)	142,053	0.3	6,456 (4.8%)	40,721,988	2,290,038 (6.0%)
1949..	232,125	0.5	27,895 (13.7%)	148,107	0.3	6,054 (4.3%)	42,850,781	2,128,793 (5.2%)
1950..	234,728	0.5	2,603 (1.1%)	156,690	0.3	8,583 (5.8%)	44,986,294	2,135,513 (5.0%)
1951..	247,532	0.5	12,804 (5.5%)	162,881	0.3	6,191 (4.0%)	46,821,879	1,835,585 (4.1%)
1952..	256,294	0.5	8,762 (3.5%)	158,228	0.3	−4,653 (2.9%)	48,450,571	1,628,692 (3.5%)
1953..	271,947	0.5	15,653 (6.1%)	160,465	0.3	2,237 (1.4%)	49,899,065	1,448,494 (3.0%)
1954..	280,819	0.5	8,872 (3.3%)	164,621	0.3	4,156 (2.6%)	51,214,559	1,315,494 (2.6%)
1955..	287,788	0.5	6,969 (2.5%)	171,416	0.3	6,795 (4.1%)	52,558,601	1,344,042 (2.6%)
1956..	295,518	0.5	7,730 (2.7%)	176,615	0.3	5,199 (3.0%)	53,994,893	1,436,292 (2.7%)
1957..	308,751	0.6	13,233 (4.5%)	183,344	0.3	6,729 (3.8%)	55,171,089	1,176,196 (2.2%)
1958‡.	315,000	0.6	6,249 (2.0%)	190,000	0.3	6,656 (3.6%)	56,210,000	1,038,911 (1.9%

Boosting Total to $9.7 Billion—Up 4.8%.

(Thousands of Dollars)

	Large Light & Power			Other Classifications			Total	
	Revenue	% Total	Annual Change	Revenue	% Total	Annual Change	Revenue	Annual Change
1942..	828,318	29.0	70,235 (9.3%)	195,034	6.8	15,802 (8.8%)	2,855,843	190,786 (7.2%)
1943..	964,192	31.3	135,874 (16.4%)	233,896	7.6	38,862 (19.9%)	3,077,643	221,800 (7.8%)
1944..	1,043,392	31.8	79,200 (8.2%)	235,436	7.2	1,450 (6.2%)	3,276,751	199,108 (6.5%)
1945..	1,001,957	30.0	−41,435 (4.0%)	231,647	6.9	− 3,789 (1.6%)	3,341,518	64,767 (2.0%)
1946..	969,349	28.0	−32,608 (3.3%)	219,983	6.4	−11,664 (5.0%)	3,459,560	118,042 (3.5%)
1947..	1,106,555	28.7	137,206 (14.1%)	224,628	5.8	4,645 (2.1%)	3,852,765	393,205 (11.4%)
1948..	1,250,684	29.0	144,129 (13.0%)	236,534	5.5	11,906 (5.3%)	4,313,313	460,548 (12.0%)
1949..	1,262,698	27.4	12,014 (1.0%)	245,257	5.3	8,723 (3.7%)	4,614,069	300,756 (7.0%)
1950..	1,404,980	27.6	142,282 (11.3%)	258,423	5.1	13,166 (5.4%)	5,086,465	472,396 (10.2%)
1951..	1,571,932	27.8	166,952 (11.9%)	273,037	4.8	14,614 (5.7%)	5,647,672	561,207 (11.0%)
1952..	1,684,073	27.4	112,141 (7.1%)	283,612	4.6	10,575 (3.9%)	6,137,272	489,600 (8.7%)
1953..	1,883,640	27.7	199,567 (11.9%)	301,454	4.4	17,842 (6.3%)	6,793,660	656,388 (10.7%)
1954..	1,977,283	27.2	93,643 (5.0%)	316,763	4.4	15,309 (5.1%)	7,277,267	483,607 (7.1%)
1955..	2,275,727	28.4	298,444 (15.1%)	336,147	4.2	19,384 (6.1%)	8,020,439	743,172 (10.2%)
1956..	2,475,476	28.5	199,749 (8.8%)	358,675	4.1	22,528 (6.7%)	8,698,308	677,869 (8.5%)
1957..	2,598,933	28.0	123,457 (5.0%)	385,300	4.1	26,625 (7.4%)	9,289,602	591,294 (6.8%)
1958‡.	2,605,000	26.8	6,067 (0.2%)	415,000	4.3	29,700 (7.7%)	9,735,000	445,398 (4.8%

Production

Source and Disposal of Energy—Millions of Kwhr

	Production		Total Production	Add Net Imports	Less Energy Used by Producer	Total for Distribution	Losses	Sales to Ultimate Consumers
	Fuel	Hydro						
1942	122,109	63,871	185,979	1,448	6,611	180,816	21,409	159,407
1943	144,127	73,632	217,759	1,537	8,729	210,567	24,678	185,889
1944	154,244	73,945	228,189	1,597	6,541	223,245	25,084	198,161
1945	142,516	79,970	222,486	1,773	3,368	220,891	27,333	193,558
1946	144,772	78,406	223,178	1,666	4,576	220,268	29,474	190,794
1947	177,313	78,426	255,739	1,269	6,186	250,822	33,241	217,581
1948	200,228	82,470	282,698	1,113	6,368	277,443	36,703	240,740
1949	201,351	89,748	291,100	1,004	5,887	286,217	37,675	248,542
1950	233,203	95,938	329,141	1,283	8,445	321,979	41,440	280,539
1951	270,922	99,751	370,673	1,721	9,356	363,038	44,870	318,168
1952	294,121	105,102	399,224	1,758	10,731	390,251	47,727	342,524
1953	337,432	105,233	442,665	1,365	9,398	434,632	50,388	384,244
1954	364,617	107,069	471,686	1,688	10,864	462,510	51,606	410,904
1955	434,063	112,975	547,038	3,310	13,908	536,440	55,519	480,921
1956	478,639	122,029	600,668	4,548	16,613	588,603	58,475	530,128
1957	501,275	130,232	631,507	3,675	18,367	616,815	58,986	557,829
1958*	504,713	140,047	644,760	3,600	19,810	628,550	59,100	569,450

Source: Federal Power Commission and Edison Electric Institute. All data revised to correspond with current basis which excludes former Mining and Manufacturing and Railroad classification. * Estimated.

Production of Electric Energy by Ownership—Millions of Kwhr

	Power Companies		Federal Agencies		Municipal, State & Power District Systems		Cooperatives	
	Production	% Total	Production	% Total	Production	% Total	Production	% Tota
1942	158,052	85.0	16,894	9.1	11,033†	5.9	.....	...
1943	180,248	82.8	24,484	11.2	13,027†	6.0	.....	...
1944	185,850	81.4	28,866	12.7	13,473†	5.9	.....	...
1945	180,926	81.3	28,000	12.6	13,560†	6.1	.....	...
1946	181,020	81.1	26,960	12.1	15,198†	6.8	.....	...
1947	208,106	81.4	29,877	11.7	17,352	6.9	404	0.2
1948	228,231	80.7	35,373	12.5	18,444	6.5	650	0.2
1949	233,112	80.1	38,102	13.1	19,122	6.6	764	0.3
1950	266,860	81.1	40,387	12.3	20,908	6.4	986	0.3
1951	301,845	81.4	44,120	11.9	23,444	6.3	1,264	0.3
1952	322,126	80.7	52,492	13.2	23,080	5.8	1,526	0.4
1953	354,271	80.0	58,064	13.1	28,433	6.4	1,896	0.4
1954	370,970	78.6	67,804	14.4	30,436	6.5	2,476	0.5
1955	420,869	76.9	89,064	16.3	34,061	6.2	3,044	0.6
1956	459,015	76.4	100,711	16.8	37,529	6.2	3,413	0.6
1957	480,943	76.2	109,176	17.3	38,358	6.1	3,030	0.5
1958*	490,305	76.0	110,438	17.1	40,733	6.3	3,285‡	0.5

Source: Federal Power Commission. † Includes Cooperatives. * Preliminary ‡ Estimated by Electrical World.

Installed Capacity by Type of Prime Mover—Mw

	Fuel			Hydro			Total	
	Capacity	% Total	Annual Change	Capacity	% Total	Annual Change	Capacity	Annual Change
1942	32,211	71.5	1,623 (5.3%)	12,842	28.5	1,025 (8.7%)	45,053	2,648 (6.2%)
1943	34,068	71.0	1,857 (5.8%)	13,883	29.0	1,041 (8.1%)	47,951	2,898 (6.4%)
1944	34,603	70.3	535 (1.6%)	14,586	29.7	703 (5.1%)	49,189	1,238 (2.6%)
1945	35,199	70.2	596 (1.7%)	14,912	29.8	326 (2.2%)	50,111	922 (1.9%)
1946	35,468	70.5	269 (0.8%)	14,849	29.5	—63	50,317	206 (0.4%)
1947	37,351	71.4	1,883 (5.3%)	14,971	28.6	122 (0.8%)	52,322	2,005 (4.0%)
1948	40,908	72.3	3,557 (9.5%)	15,652	27.7	681 (4.5%)	56,560	4,238 (8.1%)
1949	46,446	73.6	5,538 (13.5%)	16,654	26.4	1,002 (6.4%)	63,100	6,540 (11.6%)
1950	51,244	74.4	4,798 (10.3%)	17,675	25.6	1,021 (6.1%)	68,919	5,819 (9.2%)
1951	56,907	75.1	5,663 (11.1%)	18,868	24.9	1,193 (6.7%)	75,775	6,856 (9.9%)
1952	61,807	75.1	4,900 (8.6%)	20,419	24.9	1,551 (8.2%)	82,226	6,451 (8.5%)
1953	69,457	75.9	7,650 (12.4%)	22,045	24.1	1,626 (8.0%)	91,502	9,276 (11.3%)
1954	79,382	77.4	9,925 (14.3%)	23,211	22.6	1,166 (5.3%)	102,592	11,090 (12.1%)
1955	89,468	78.2	10,086 (12.7%)	25,004	21.8	1,793 (7.7%)	114,472	11,880 (11.6%)
1956	95,043	78.7	5,575 (6.2%)	25,654	21.3	650 (2.6%)	120,697	6,225 (5.4%)
1957	102,087	79.1	7,044 (7.4%)	27,036	20.9	1,382 (5.4%)	129,123	8,426 (7.0%)
1958*	113,050	79.4	10,963 (10.7%)	29,363	20.6	2,327 (8.6%)	142,413	13,290 (10.3%)

Source: Federal Power Commission. * Preliminary.

Generating Capacity by Ownership—Mw

	Power Companies		Federal		Municipal, State and Power District		Cooperatives	
	Capacity	% Total	Capacity	% Total	Capacity	% Total	Capacity	% Total
1942	37,442	83.1	3,216	7.1	4,395†	9.8		
1943	39,128	81.6	4,322	9.0	4,501†	9.4		
1944	39,733	80.8	4,886	9.9	4,570†	9.3		
1945	40,307	80.4	5,081	10.2	4,723†	9.4		
1946	40,335	80.2	4,920	9.8	5,062†	10.0		
1947	41,987	80.2	5,027	9.6	5,141	9.9	167	0.3
1948	45,381	80.2	5,526	9.8	5,453	9.6	200	0.4
1949	50,484	80.0	6,210	9.8	6,168	9.8	238	0.4
1950	55,175	80.1	6,921	10.0	6,511	9.4	312	0.5
1951	60,192	79.4	8,099	10.7	6,993	9.2	491	0.6
1952	64,349	78.4	9,678	11.8	7,667	9.3	532	0.6
1953	71,201	77.8	11,358	12.4	8,343	9.1	600	0.7
1954	79,127	77.1	13,567	13.2	9,130	8.9	768	0.7
1955	86,887	75.9	16,962	14.8	9,823	8.6	800	0.7
1956	91,145	75.5	18,336	15.2	10,421	8.6	795	0.7
1957	97,376	75.4	19,649	15.2	11,177	8.7	920	0.7
1958*	107,936	75.8	20,436	14.3	13,077	9.2	964‡	0.7

Source: Federal Power Commission. * Preliminary † Includes Cooperatives. ‡ Estimated by Electrical World

Manufacturers Shipments Dropped

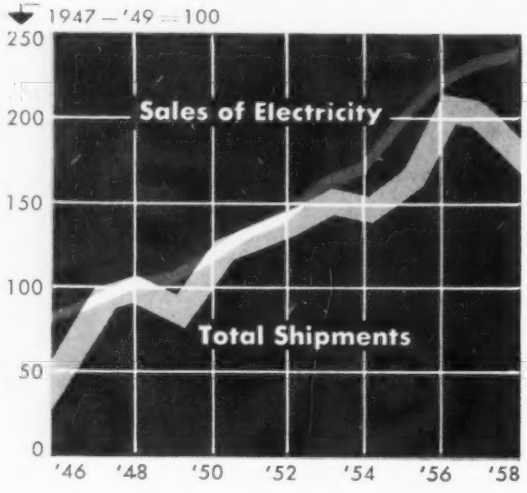
Total shipments of electrical products plummeted 10.1% to $19.5 billion in 1958 reflecting the sharp slump in overall economic activity. This drop, following a slight dip in 1957, put 1958 shipments 11.1% behind the $21.9 billion record set in 1956.

Appliances, which account for roughly 19% of total electrical products shipments, made an equally bad showing by falling off 9.2% to $3.8 billion. Since this is the third decline in a row for this group, their 1958 total was 19.7% under the $4.7 billion peak registered in 1955. For a detailed analysis of individual appliance shipments last year see page 94.

With industrial capital expenditures considerably under 1957, shipments of industrial electrical apparatus declined $422 million to $2.7 billion—a drop of 13.4%. Also reflecting this cutback in capital expenditures is the building equipment and suplies group which experienced a 9.1% drop in 1958 shipments to $649 million.

Following appliances and "other" products the third largest decline in terms of dollars was chalked

Total Shipments of Electrical Products

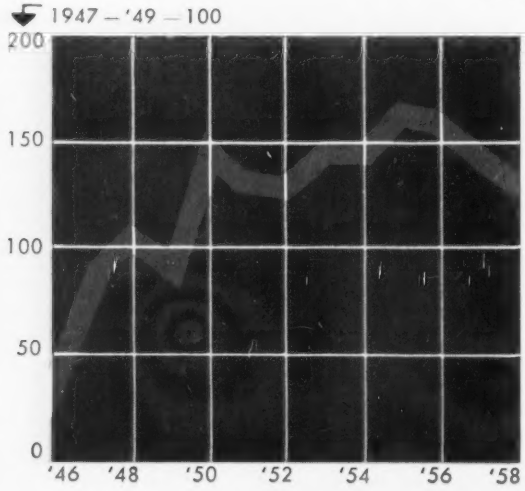


The data shown in this tabulation are based upon total industry shipments including exports and interplant transfers of electrical products which are considered to cover, not only those products included in the Electrical Machinery Group as defined by the U. S. Census of Manufacturers, but also lighting fixtures, steam engines and turbines, household and commercial refrigeration machinery, air conditioning machinery, household laundry equipment, vacuum cleaners and electrical insulating materials such as porcelain, mica, laminated products, vulcanized fiber, varnished fabric and paper.

Non-Electrical Products: **have not been** included in these data.

	$ Millions	Index 1947–'49 = 100
1946...	6,053.9	58.8
1947...	10,048.2	97.7
1948...	10,858.5	105.6
1949...	9,948.9	96.7
1950...	13,068.5	127.1
1951...	14,168.3	137.7
1952...	14,883.6	144.8
1953...	16,310.4	158.7
1954...	15,695.1	152.6
1955...	17,584.5	171.0
1956...	21,888.2	212.8
1957...	21,643.5	210.4
1958...	19,464.7	189.2

Appliances



Appliances, includes, electric household refrigerators, electric farm and home freezers, electric ranges, electric water heaters, electric housewares, electric fans, electric commercial cooking equipment, electric dehumidifiers, electric household food waste disposers and dishwashers, packaged room air conditioners, electric dryers, electric ironers, electric washing machines, vacuum cleaners, and radio and television receiving sets.

	$ Millions	Index 1947–'49 = 100
1946...	1,231.6	44.6
1947...	2,530.6	91.6
1948...	3,033.5	109.8
1949...	2,721.2	98.5
1950...	4,216.5	152.6
1951...	3,791.2	137.2
1952...	3,688.6	133.5
1953...	4,155.2	150.3
1954...	4,145.1	150.1
1955...	4,675.8	169.3
1956...	4,558.9	165.1
1957...	4,138.8	149.9
1958...	3,756.3	136.0

10.1% to $19.5 Billion in 1958

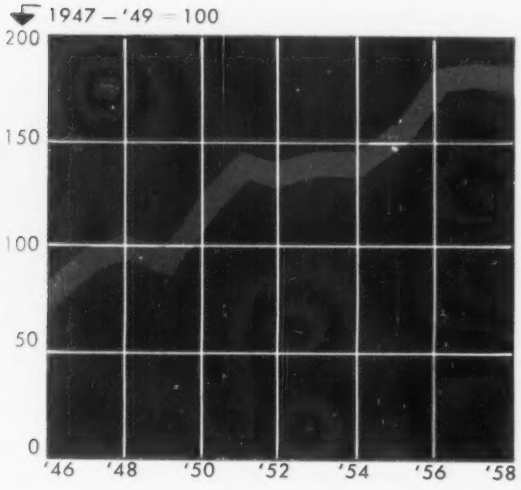
up by the generation, transmission and distribution group. Shipments of these products dropped $358 million—off 15.2% from the high of $2.4 billion established in 1957.

However, insulated wire and cable shipments by far made the worst showing percentagewise in 1958. Reflecting the stiff competition which plagued this group throughout the year, total W & C shipments fell 20.2% to $1.3 billion. This put 1958 factory sales $531 million or 28.9% under the high of $1.8 billion set in 1956. The high of $1.8 billion, of course, was considerably inflated by copper prices that year.

With decreased shipments of all electrical products, sales of insulating materials also declined in 1958 falling 10.8% to $304 million.

The only bright spots were shipments of signal and communication equipment and illuminating equipment. The former held even with the 1957 peak of $1.3 billion while the latter dipped a scant 2.0% to $856 million. Shipments of "other electrical products" declined 8.0% to $6.5 billion.

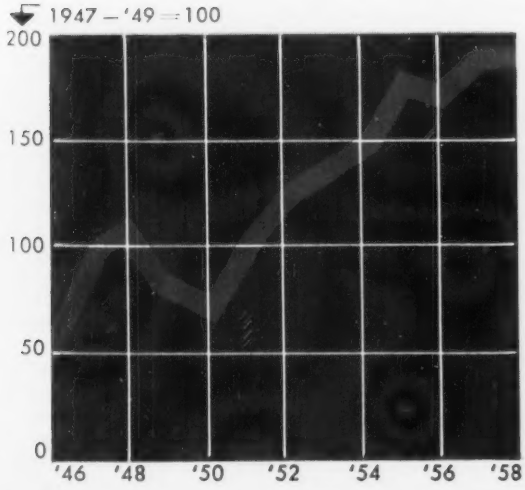
Illuminating Equipment



	$ Millions	Index 1947–'49 = 100
1946...	383.9	82.0
1947...	460.8	98.4
1948...	483.5	103.3
1949...	459.6	98.2
1950...	582.0	124.3
1951...	667.4	142.6
1952...	647.8	138.4
1953...	670.3	143.3
1954...	670.7	143.4
1955...	737.8	157.7
1956...	855.8	182.9
1957...	872.9	186.5
1958...	855.8	182.9

Illuminating Equipment includes, industrial, commercial and residential lighting equipment; aviation ground lighting, floodlighting and street lighting equipment; vehicular, railway and other lighting equipment; and portable lamps.

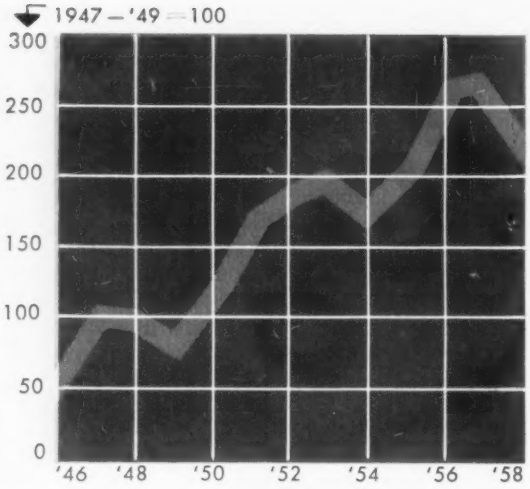
Signalling and Communication Equipment



	$ Millions	Index 1947–'49 = 100
1946...	468.5	67.1
1947...	702.6	100.6
1948...	791.1	113.3
1949...	599.9	85.9
1950...	535.8	76.7
1951...	731.7	104.8
1952...	889.8	127.4
1953...	961.1	137.6
1954...	1,053.7	151.0
1955...	1,260.0	180.6
1956...	1,234.8	176.9
1957...	1,345.7	192.8
1958...	1,345.7	192.8

Signalling and Communication Equipment includes, signaling apparatus, telephone and telegraph equipment, and electric railway signals and attachments.

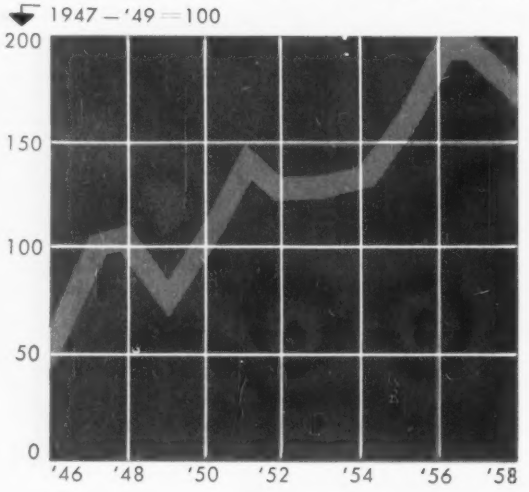
Industrial Apparatus



Industrial Apparatus includes, carbon products, commutators, electronic tubes, (except radio and cathode ray), welding wire, welding machines, resistance welders, industrial heating units and devices, industrial controls, induction and dielectric heating apparatus, mining belt conveyors, motors and generators (except large apparatus), mining and industrial electric locomotives, metallic rectifiers, and renewal parts for motors, generators and mining and industrial locomotives.

	$ Millions	Index 1947–'49 = 100
1946...	739.8	64.3
1947...	1,234.5	107.3
1948...	1,193.4	103.8
1949...	1,020.0	88.7
1950...	1,422.0	123.7
1951...	1,985.6	172.7
1952...	2,214.3	192.5
1953...	2,351.2	204.5
1954...	2,120.5	184.5
1955...	2,432.6	211.7
1956...	3,089.4	268.8
1957...	3,153.2	274.4
1958...	2,731.1	237.6

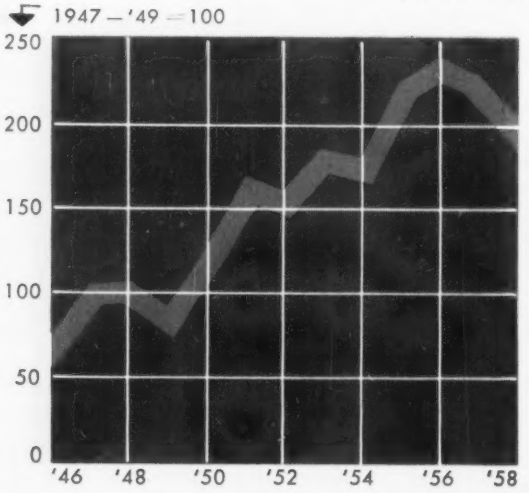
Building Equipment and Supplies



Building Equipment and Supplies includes, conduit fittings, metallic and plastic outlet and switch boxes, rigid steel conduit and electrical metallic tubing and fittings, wiring devices, molded case breakers, busways, fuses, switch and enclosed breakers, and panelboards and distribution boards.

	$ Millions	Index 1947–'49 = 100
1946...	234.5	65.6
1947...	378.1	105.8
1948...	395.7	110.8
1949...	297.9	83.4
1950...	403.7	113.0
1951...	533.7	149.4
1952...	474.6	132.8
1953...	478.2	133.9
1954...	491.7	137.6
1955...	590.1	165.2
1956...	714.0	199.9
1957...	713.7	199.8
1958...	648.8	181.6

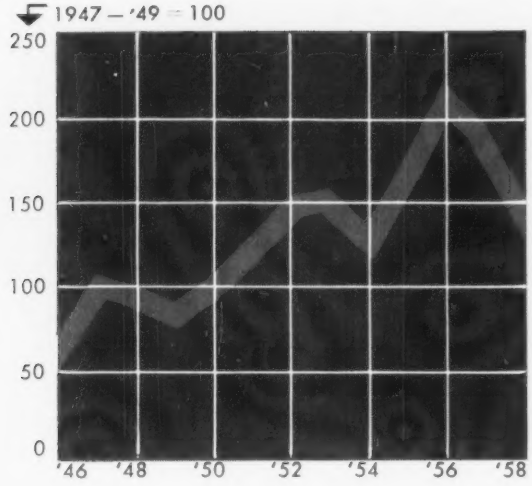
Insulating Materials



Electrical Insulating Materials includes, standard and special dry process electrical porcelain, steatite electrical products, laminated products, manufactured electrical mica, varnished fabric and paper, varnished tubing and saturated sleeving, and vulcanized fiber.

	$ Millions	Index 1947–'49 = 100
1946...	113.4	76.3
1947...	154.6	104.1
1948...	156.4	105.4
1949...	134.2	90.4
1950...	193.2	130.1
1951...	248.9	167.8
1952...	236.9	159.6
1953...	274.1	184.7
1954...	267.4	180.2
1955...	334.2	225.2
1956...	354.3	238.7
1957...	340.4	229.4
1958...	303.5	204.5

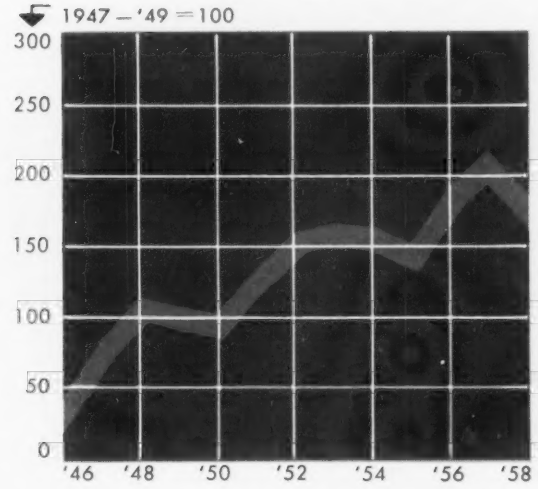
Insulated Wire and Cable



	$ Millions	Index 1947–'49 = 100
1946	603.2	72.7
1947	895.1	107.9
1948	838.7	101.1
1949	752.8	90.8
1950	879.9	106.2
1951	1,097.1	132.4
1952	1,265.9	152.8
1953	1,310.5	158.1
1954	1,140.7	137.6
1955	1,483.0	178.8
1956	1,838.9	221.8
1957	1,638.6	197.7
1958	1,307.5	157.7

Insulated Wire and Cable includes, rubber and thermoplastic power and control cable, asbestos insulated wire and cable, flexible cords, cord sets, fixture and appliance wire, magnet wire, paper power cable, building wire and cable, portable molded rubber sheathed cord and cable, varnished cambric cable, weatherproof and slow-burning wire, communication and signal wire and cable, automotive, aircraft and marine wire and cable, and non-metallic sheathed cable.

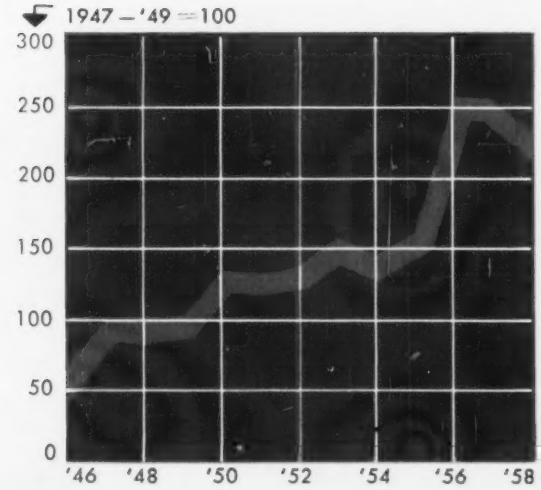
Generating, Transmission & Distribution Equipment



	$ Millions	Index 1947–'49 = 100
1946	469.6	43.4
1947	911.5	84.2
1948	1,202.6	111.1
1949	1,132.3	104.6
1950	1,095.9	101.3
1951	1,437.3	132.8
1952	1,709.7	158.0
1953	1,780.1	164.5
1954	1,768.3	163.4
1955	1,630.0	150.6
1956	2,086.4	192.8
1957	2,356.1	217.7
1958	1,998.6	184.7

Generation, Transmission, and Distribution Equipment includes, power capacitors, electric measuring and test equipment, transmission and distribution voltage regulators, hydraulic turbines, high voltage insulators, lightning protective devices, generating and converting apparatus, marine turbine-propulsion, overhead trolley line materials, switchgear, power and distribution transformers, land steam and gas turbines, pole line hardware, rail bonds, transmission hardware, and other related products.

Other Electrical Products



	$ Millions	Index 1947–'49 = 100
1946	1,809.4	64.8
1947	2,780.4	99.5
1948	2,763.5	98.9
1949	2,830.9	101.3
1950	3,739.4	133.8
1951	3,675.4	131.6
1952	3,756.0	134.5
1953	4,329.7	155.0
1954	4,037.0	144.6
1955	4,441.0	159.1
1956	7,155.7	256.3
1957	7,084.1	253.8
1958	6,517.4	233.5

Other Electrical Products includes, radio, electronic and television transmission and communication equipment, automatic temperature controls, specialty capacitors, specialty transformers, ballast (fluorescent), time switches, X-ray tubes, X-ray apparatus, land transportation motors and controls, electric lamps, air conditioning and commercial refrigeration equipment, radio receiving-type tubes, cathode ray tubes, engine electrical equipment, phonographs, phonograph records, recording devices, storage batteries, primary batteries, electrical hearing aids, lamp components, Christmas tree lighting outfits, and other related products.

The Beginning of a Recovery: Sales of Appliances,

	1957			1958			1958 vs 1957	
	Units (Thousands)	Average Price	Retail Value (Thousands)	Units (Thousands)	Average Price	Retail Value (Thousands)	Units % Change	Retail Value % Change
Air Conditioners, Room	1,586	$310.00	$491,660	1,550	$305.00	$472,750	− 2.3	− 3.8
Bed Coverings, Electric *	2,200	26.00	57,200	2,410	24.95	60,129	+ 9.5	+ 5.1
Blenders	455	37.95	17,267	430	36.95	15,888	− 5.5	− 8.0
Cleaners, Vacuum, Floor	3,190	84.37	269,140	3,295	88.60	291,937	+ 3.3	+ 8.5
Clocks	8,400	6.50	54,600	8,100	6.55	53,000	− 3.6	− 2.9
Coffee Makers, Automatic	4,365	19.50	85,100	4,200	18.95	79,590	− 3.8	− 6.5
Corn Poppers	550	5.25	2,887	595	5.75	3,421	+ 8.2	+18.5
Dehumidifiers	225	116.00	26,100	210	105.00	22,050	− 6.7	−15.5
Dishwashers, Motor-Driven **	390	268.00	104,250	400	275.00	110,000	+ 2.6	+ 5.5
Dryers, Clothes, Total	1,294	228.75	295,998	1,211	226.00	273,840	− 6.4	− 7.5
Electric	894	217.00	193,998	826	215.00	177,590	− 7.6	− 8.5
Gas	400	255.00	102,000	385	250.00	96,250	− 3.7	− 5.6
Fans								
Attic	98	129.95	12,735	92	125.00	11,500	− 6.1	− 9.7
Desk and Bracket	1,725	19.95	34,415	1,390	18.50	25,715	−19.4	−25.3
Hassock or Floor	105	49.50	5,197	85	49.50	4,208	−19.0	−19.0
Kitchen Exhaust & Range Hood Types	1,345	37.00	49,765	1,050	37.00	38,850	−21.9	−21.9
Window Ventilating	1,700	42.25	71,825	1,350	42.50	57,375	−20.6	−20.1
Portable Roll-Abouts	330	52.00	17,160	365	49.00	17,885	+10.6	+ 4.2
Floor Polishers *	595	49.95	29,720	725	49.00	35,525	+21.8	+19.5
Food Waste Disposers *	550	89.95	49,473	620	89.95	55,769	+12.7	+12.7
Freezers, Home **	925	375.00	346,875	1,100	350.00	385,000	+18.9	+11.0
Fryers, Deep Fat	1,100	14.95	16,445	475	15.95	7,576	−56.8	−39.3
Frypan-Skillets	5,200	18.95	98,500	3,750	18.95	71,062	−27.8	−27.9
Heaters, Convector & Radiant, Total	1,855	29.25	54,224	1,925	29.50	56,830	+ 3.8	+ 4.8
Fan-Forced & Fan-Htr. Portables *	925	21.95	20,305	985	21.95	21,621	+ 6.5	+ 6.5
Non-Fan Forced Portable	295	23.50	6,932	270	23.70	6,399	− 8.5	− 7.7
Wall Type & Baseboard *	635	42.50	26,987	670	43.00	28,810	+ 5.5	+ 6.8
Heating Pads	2,055	6.10	12,535	1,920	6.25	11,994	− 6.6	− 4.3
Hotplates	660	7.95	5,247	610	7.95	4,850	− 7.6	− 7.6
Ironers	44	218.00	9,592	35	215.00	7,525	−20.5	−21.5
Irons:								
Automatic	1,650	9.95	16,417	1,100	9.95	10,945	−33.3	−33.3
Travel	550	7.95	4,372	475	7.95	3,776	−13.6	−13.6
Steam	5,425	16.95	91,950	3,975	17.95	71,351	−26.7	−22.4
Kitchen Cabinets, Steel	2,490	.....	150,120	.....	.....	.....	.....	.....

Appliance Sales Take 7.5% Drop

TED WEBER, Managing Editor, Electrical Merchandising

The appliance-TV industry, a victim of the recession as early as 1957, made an encouraging start in 1958 toward recovering lost ground.

To be sure, overall sales declined once again, dropping from $8.0 billion (retail value) to $7.4 billion, an even sharper (7.5%) drop than that experienced in 1957 when sales fell 6.0% from 1956's record high.

In addition, sales of certain staple, big volume items (TV, refrigerators, and laundry) all slumped in 1958.

But despite somewhat discouraging year-end figures like these, the really significant development in 1958 appeared to be the strong improvement in sales which set in during the final months of the year. This recovery, coupled with outstanding year-round performances by several growth appliances, provides a framework for the optimism which pervades the industry as the new year opens.

Even among those major appliances which suffered reverses in 1958, the losses were somewhat smaller than many observers had expected early in the year. Air conditioners, despite a poor summer weather-wise, dropped only 2.3% and washers

Lamps, Radio and TV in 1958 as Compared with 1957

	1957			1958			1958 vs 1957	
	Units (Thousands)	Average Price	Retail Value (Thousands)	Units (Thousands)	Average Price	Retail Value (Thousands)	Units % Change	Retail Value % Change
Lamp Bulbs & Tubes, Total	2,683,422	.....	$870,000	2,605,000	.....	$868,000	− 2.9	− 0.2
Fluorescent	109,056	.....	180,000	105,000	.....	180,000	− 3.7	.....
Large Incandescent	1,091,800	.....	355,000	1,075,000	.....	360,000	− 1.5	+ 1.4
Photo	596,566	.....	98,000	575,000	.....	97,000	− 3.6	− 1.0
Miniature (incl. "L")	471,000	.....	187,000	425,000	.....	180,000	− 9.8	− 3.7
Christmas Tree	415,000	.....	50,000	425,000	.....	51,000	+ 2.4	+ 2.0
Lawn Mowers, Power*	3,300	$84.50	278,850	3,452	$84.50	291,694	+ 4.6	+ 4.6
Mixers, Food								
Standard	1,200	44.00	52,800	770	39.50	30,415	−35.8	−42.4
Portable	2,400	18.50	44,400	1,995	18.50	36,907	−16.9	−16.9
Oil Space Heaters	331	102.00	33,823	235	110.00	25,850	−29.1	−23.6
Phonographs — Record Players:								
Single Players	3,717	90.00	334,620	3,300	100.00	330,000	−11.2	− 1.4
Combination Units	1,048	270.00	282,960	750	315.00	236,250	−28.4	−16.5
Record Player Attachments	213	40.00	8,520	100	40.00	4,000	−53.1	−53.1
Radio:								
Home Radios	4,151	25.00	103,775	3,451	25.00	86,275	−16.9	−16.9
Portable Radios	3,265	42.00	137,130	3,373	45.00	151,785	+ 3.3	+10.7
Clock Radios	2,516	34.00	85,544	2,038	34.00	69,292	−19.0	−19.0
Ranges, Total	1,365	265.00	361,675	1,335	266.00	354,870	− 2.2	− 1.9
Standard	940	255.00	239,700	800	255.00	204,000	−14.9	−14.9
Built-In*	425	287.00	121,975	535	282.00	150,870	+25.9	+23.7
Recorders, Magnetic	500	200.00	100,000	400	175.00	70,000	−20.0	−30.0
Refrigerators	3,350	320.00	1,072,000	3,050	320.00	976,000	− 9.0	− 9.0
Sharpeners, Knife	245	15.75	3,859	355	15.75	5,591	+45.0	+45.0
Shavers	6,650	19.95	132,667	6,400	19.50	124,800	− 3.8	− 5.9
Television, B & W	6,399	190.00	1,215,800	4,920	205.00	1,008,600	−23.1	−17.0
Toasters, Automatic & Non-Auto.	4,000	17.97	71,874	3,400	18.00	61,290	−15.0	−14.7
Waffle Irons — Sand. Grills	895	19.95	17,855	775	19.95	15,460	−13.4	−13.4
Washing Machines:								
Automatic	2,814	280.00	787,920	2,744	280.00	768,320	− 2.5	− 2.5
Non-Automatic	977	155.00	151,435	948	155.00	146,940	− 3.0	− 3.0
Washer-Dryer Combinations	179	510.00	91,443	164	485.00	79,540	− 8.5	−13.0
Water Heaters, Storage	800	105.00	84,000	820	105.00	86,100	+ 2.5	+ 2.5
Water Softeners	507	253.00	128,397	500	225.00	112,500	− 1.5	−12.4
Water Systems	750	150.00	112,500	720	155.00	111,600	− 4.0	− 0.8

* New record ** Ties previous record

Source: *Electrical Merchandising*

Upturn during final months of year takes edge off long decline. Among gainers for year are built-in ranges, water heaters, and home freezers

were down less than 3.0%. Other losses among major appliances were registered by dryers (6.4%), refrigerators (9.0%) and standard ranges (14.9%).

Among smaller appliances, electric bed coverings, floor polishers, and two types of heaters showed gains in 1958 and established new records. Many electric housewares, however, fell off sharply from 1957 totals. Declines of 26.7% in steam irons, 16.9% in portable mixers, 15.0% in toasters, and 27.8% in frypan-skillets can all be traced in some extent to the chaotic marketing conditions which demoralized the industry after the abandonment of Fair Trade pricing practices by several key producers early in the year.

Despite the prevailing optimism, however, the industry is well aware of the problems which face it at the moment. Probably chief among these is the fact that it must operate today in a replacement market—a market in which saturation has grown to the point where the majority of sales of staple items involve replacement of a similar product already in use.

The impact of such replacement selling on the market is readily apparent from the charts on page 96. The refrigerator statistics in these charts provide a good example of the problem. Almost 98% of homes now have a household refrigerator, a

Index of Saturation

JANUARY 1, 1959

	Number and Percentage of Wired Homes With	
Air Conditioners (room)	5,765,000	11.7
Bed Coverings	8,850,000	17.9
Blenders	3,450,000	7.0
Clocks*	37,750,000	76.4
Coffee Makers (automatic)	23,575,000	47.7
Dehumidifiers	1,095,000	2.2
Dishwashers	2,885,000	5.8
Dryers, Clothes (elec & gas)	7,725,000	15.6
Food Waste Disposers	4,175,000	8.5
Freezers	10,350,000	21.0
Frypan-Skillets	17,925,000	36.3
Heaters, Portable (elec)	13,675,000	27.7
Heating Pads	18,665,000	37.8
Hotplates	11,680,000	23.6
Ironers	4,330,000	8.8
Irons (standard)	44,000,000	89.1
Steam Irons	26,000,000	52.6
Mixers	24,675,000	50.0
Phonographs	28,000,000	56.7
Radio**	49,225,000	96.3
Ranges (standard)	14,725,000	29.8
Ranges (built-in)	1,988,000	4.0
Refrigerators	48,250,000	97.7
Sandwich-Wafflers (comb)	17,000,000	34.4
Shavers	31,000,000	62.8
Television**	43,950,000	89.0
Toasters	38,950,000	79.9
Vacuum Cleaners	35,000,000	70.9
Washers, Electric	44,900,000	90.9
Water Heaters	8,975,000	18.2

* Adjusted Jan. 1958
** NBC — ARF — NAB — Nielsen

Source: *Electrical Merchandising*

fact which quickly explains why 77% of refrigerator sales now involve a replacement.

High as it is, this figure (as well as those for freezers, ranges, washers and dishwashers) is down slightly from 1957 levels, perhaps reflecting a pickup in home building in 1958 (with a corresponding increase in the number of new installations of appliances.) Nevertheless, the high percentage of replacement sales on staple items and the growing replacement business in growth appliances (dishwashers, dryers, room air conditioners and disposers) are significant challenges which the industry must meet.

It is these growth appliances, incidentally, which provide the real explanation of why the industry did as well as it did in 1958. Dishwashers, disposers, freezers and built-in ranges showed gains ranging from 5 to 23% and, in each case, either tied or established new sales records. Also showing a strong gain, but falling somewhat short of its previous record, was the electric water heater.

Once again in 1958 the gas appliance industry proved to be a hardy competitor. Although dryers and ranges of both types suffered losses and water heaters of both kinds registered gains, the edge in each case went to the gas-fueled product. Thus, gas dryers fell only 3.7% as against a decline of 7.6% for electrics. Standard electric ranges dropped 14.9% while gas units fell only 8.8%. And the gain of 2.5% in sales of electric water heaters was more than matched by a gain of 3.5% in gas units.

Almost 230 power companies provided answers to ELECTRICAL MERCHANDISING's fifteenth annual utility survey. Of this number, two-thirds said they did not plan to merchandise appliances in 1959, a figure virtually unchanged from last year's survey. This study also indicates that the number of appliance dealers in the areas served by these utilities has decreased in the past year. The 204 companies providing estimates on this question for both 1957 and 1958 indicated that there were 2.85% fewer dealers in 1958. Sharpest mortality was shown in the West North Central and Pacific regions while utilities in the Mountain area reported an increase of 11.36% in retailers in their area.

Replacements and Trade-ins—Percent of Total Sales

	1958		1957		1956		1955		1954		1953	
	Trade-Ins	Replacements	Trade-Ins	Replacements	Trade-Ins	Replacements	Trade-Ins	Replacements	Trade-Ins	Replacements	Trade-Ins	Replacements
Freezers	7.7	14.9	9.5	15.4	7.1	14.1	6.7	12.6	5.5	9.0	4.2	15.7
Refrigerators	52.9	77.2	46.8	79.2	54.2	77.4	45.3	72.1	49.0	69.9	47.0	74.6
Ranges	38.6	61.6	42.6	62.2	42.7	59.7	35.1	63.6	40.8	53.3	27.8	44.1
Washers	50.2	73.3	50.4	74.1	54.8	76.8	47.7	71.3	49.0	67.0	54.5	71.6
Ironers	....	....	6.5	14.9	2.8	17.1	1.9	12.7	2.6	6.9	2.2	12.8
Vacuum Cleaners	14.7	63.4	15.7	62.3	31.9	59.7	27.7	64.1	23.7	58.9	26.7	72.1
Water Heaters	7.4	50.4	10.5	44.7	12.2	43.6	7.5	51.1	10.2	49.3	6.0	37.2
Television	45.6	65.2	36.8	59.4	36.6	52.2	24.5	38.8	22.7	40.3	17.6	26.1
Dishwashers	2.2	9.6	3.0	17.9	2.8	7.4	2.5	5.9	1.2	5.0	....	....
Dryers, Clothes	6.6	18.9	7.0	13.6	6.0	12.5	4.4	8.3	3.1	12.9	....	....
Room Air Cond'ers	2.5	11.6	1.3	5.9	1.8	3.9	0.9	2.4	0.5	2.0	....	....
Disposers	2.6	11.8	....	....	....	....	....	....	....	....	....	....

Source: *Electrical Merchandising*

Co-op Sales Up 10.3%, Revenue 7.5%

REA-financed power systems sold 21.7 billion kwhr in 1958—10.3% more than the 19.7 billion kwhr sold in 1957. Operating revenues for all borrowers during this period hit $563 million as compared with $524 million in 1957 for a 7.5% gain.

Revenue per kwhr in 1958 amounted to 2.18¢—.06¢ or 2.7% less than in the previous year. Cost of energy input for all REA borrowers declined 0.2 mills or 2.8% from the 7.1 mill level registered since 1955.

Average revenue for residential consumers, including farm and non-farm, dropped to a new low of 2.68¢ per kwhr in 1958 as compared with 2.77¢ in 1957 and 2.87¢ in 1956. At the same time the average residential bill hit $97.92—$3.72 more than in 1957.

Average annual consumption by REA residential consumers increased 252 kwhr from 3,396 kwhr in 1957 to 3,648 this past year.

As of December 31, 1958 there were 1,030 REA systems in operation serving 4,590 thousand rural customers.

Statistics of REA-Financed Systems

	1956	1957	1958[1]
CUMULATIVE YEAR-END DATA			
Total Loans Approved	$3,343,093,555	$3,633,663,287	$3,846,620,615
Distribution Lines	2,647,764,122	2,821,177,793	2,938,385,204
Generation and Transmission	663,522,063	776,505,160	868,542,478
Consumer Facilities	31,807,370	35,980,334	39,692,933
Funds Advanced	2,838,809,216	3,051,554,838	3,254,776,704
Systems in Operation	1,026	1,030	1,030
Miles of Line in Operation	1,382,737	1,405,327	1,426,000
Consumers Served	4,361,896	4,466,444	4,590,000
Systems Generating Power During Year	74	76	76
Generating Plants—Kw Capacity (Active Only)	868,010	1,013,115	1,093,000
ANNUAL DATA			
Energy Generated—Kwhr	3,612,364,000	3,291,162,000	3,569,000,000
Energy Purchased—Kwhr[2]	17,265,830,000	19,266,304,000	21,247,000,000
Total System Input—Kwhr[2]	20,878,194,000	22,557,466,000	24,816,000,000
Energy Sold—Kwhr[2]	18,197,414,000	19,676,628,000	21,705,000,000
Operating Revenues[3]	$491,184,729	$523,783,014	$563,100,000
Operating Deductions Total	384,411,837	417,484,513	451,100,000
Cost of Power[4]	171,114,577	186,005,134	199,600,000
Distribution Expenses—Operations	34,145,338	37,498,905	41,400,000
Distribution Expenses—Maintenance	17,314,402	18,918,397	20,400,000
Consumers Accounting & Collecting	16,551,083	17,784,362	19,600,000
Admin. & General Expenses	39,922,944	43,739,855	45,500,000
Electric Sales Promotion Expenses	6,160,201	7,449,315	9,100,000
Depreciation	84,305,649	89,573,459	97,100,000
Amortization of Intangibles	1,211,319	1,259,159	1,400,000
Taxes	13,686,324	15,255,927	17,000,000
Utility Operating Margin	106,772,892	106,298,501	112,000,000
Non-operating Margin	6,394,526	7,937,080	8,800,000
Interest on Long Term Debt	43,561,023	45,283,356	47,200,000
Interest Charged to Construction Cr	442,713	458,929	300,000
Other Deductions	659,486	510,763	500,000
Net Margin	69,389,622	68,900,391	73,400,000
PAYMENTS TO GOVERNMENT—CUMULATIVE DATA			
Interest Due	$265,803,357	$306,600,910	$350,287,898
Interest Paid	265,763,036	306,535,317	350,163,823
Principal Due	429,339,178	503,361,117	582,725,560
Principal Paid	535,190,040	624,291,276	725,414,255
Overdue Amounts—More than 30 days	233,873	123,206	137,553
a. Interest	25,752	21,032	33,336
b. Principal	208,121	102,174	104,217
Advance Payments[5]	102,641,270	117,483,376	138,972,625

Source: Monthly Operating Reports of Rural Electrification Administration borrowers and records of Rural Electrification Administration.

[1] Operating and financial statistics of borrowers are based on nine months actual data.
[2] Excludes energy sales between REA borrowers.
[3] Includes revenues from sales of power between REA borrowers.
[4] Cost of Power includes cost of purchased power and prime costs involved in the production and transmission of generated energy.
[5] Advance payments are included in Principal Paid.

Coal Rate Drops to 0.91 lb per Kwhr

The coal rate of fuel plants in 1958 dropped to 0.91 lb per kwhr from the 1957 level of 0.93 to record an improvement of 2.2%.

Coal accounted for 68.2% of the energy produced thermally during 1958 compared with 69.1% in 1957. Energy produced from oil held at about 8% of the total while gas accounted for 23.7% as against 22.8% in 1957.

Consumption of coal by utilities declined by 5.1 million tons or 3.1% from the peak 160.8 million tons used in 1957. Oil use also declined during 1958 falling 2.6% to 77.7 million barrels. Gas consumption increased 2.7% to 1,373 billion cu. ft.

Use of hydro capacity increased to 4,966 hours as compared with 4,943 hours in 1957. On the other hand, use of fuel capacity dropped 7.7% to 4,692 hours from 5,086 hours the previous year.

Production, Capacity, Average Use

	Production Millions of Kwhr			Year End Capacity Thousands of Kw			Kwhr per Kw of Average Capacity		
	Fuel	Hydro	Total	Fuel	Hydro	Total	Fuel	Hydro	Total
1946	144,772	78,406	**223,178**	35,468	14,849	**50,317**	4,097	5,269	**4,445**
1947	177,313	78,426	**255,739**	37,351	14,971	**52,322**	4,870	5,260	**4,983**
1948	200,228	82,470	**282,698**	40,908	15,652	**56,560**	5,052	5,386	**5,193**
1949	201,352	89,748	**291,100**	46,446	16,654	**63,100**	4,610	5,561	**4,865**
1950	233,203	95,938	**329,141**	51,244	17,675	**68,919**	4,774	5,589	**4,986**
1951	270,922	99,751	**370,673**	56,907	18,868	**75,775**	5,010	5,460	**5,123**
1952	294,121	105,103	**399,224**	61,807	20,419	**82,226**	4,955	5,350	**5,054**
1953	337,432	105,233	**442,665**	69,457	22,045	**91,502**	5,141	4,957	**5,096**
1954	364,617	107,069	**471,686**	79,381	23,211	**102,592**	4,899	4,732	**4,860**
1955	434,063	112,975	**547,038**	89,468	25,004	**114,472**	5,141	4,686	**5,040**
1956	478,639	122,029	**600,668**	95,043	25,654	**120,697**	5,188	4,818	**5,108**
1957	501,275	130,232	**631,507**	102,087	27,036	**129,123**	5,086	4,943	**5,056**
1958*	504,713	140,047	**644,760**	113,050	29,363	**142,413**	4,692	4,966	**4,749**

Source: Federal Power Commission. * Preliminary. 1945 and after excludes former Mining and Manufacturing and Railroad and Railway classifications

Consumption of Coal, Oil and Gas

	Energy Generated From Coal, Oil, and Gas				Coal, Oil, and Gas Consumed				Coal Rate
	Coal Billions of Kwhr	Oil Billions of Kwhr	Gas Billions of Kwhr	Total Billions of Kwhr	Coal Millions of Tons	Oil Millions of Bbls	Gas Billions of Cu Ft	Coal and Equivalent of Oil and Gas Millions of Tons	Pounds per Kwhr
1946	111.7	14.1	18.8	144.6	72.20	36.32	306.94	93.47	1.29
1947	137.0	16.9	23.1	177.0	89.53	45.31	373.05	115.67	1.31
1948	152.9	16.8	30.1	199.8	99.59	42.64	478.10	130.12	1.30
1949	135.5	28.5	37.0	201.0	83.96	66.30	550.12	124.57	1.24
1950	154.5	33.7	44.6	232.8	91.87	75.42	628.92	138.42	1.19
1951	185.2	28.7	56.6	270.5	105.77	63.94	763.90	154.50	1.14
1952	195.4	29.7	68.5	293.6	107.07	67.22	910.12	160.87	1.10
1953	218.9	38.4	79.8	337.1	115.90	82.24	1,034.27	178.49	1.06
1954	239.1	31.5	93.7	364.3	118.38	66.74	1,165.50	180.37	0.99
1955	301.4	37.1	95.3	433.8	143.76	75.27	1,153.28	206.93	0.95
1956	338.5	36.0	104.0	478.5	158.28	72.71	1,239.31	223.73	0.94
1957	346.4	40.5	114.2	501.1	160.77	79.69	1,336.14	232.58	0.93
1958*	344.3	40.4	119.7	504.7†	155.71	77.65	1,372.88	228.17	0.91

Source: Federal Power Commission. * Preliminary. † Small amount of energy generated from wood, waste and nuclear fuel included in total

Changes in Installed Generating Capacity—Mw (Nameplate)

	New Additions	Retirements	Adjustments* Plus	Adjustments* Minus	Net Additions
1950					
Hydro	1,038	17	14	14	1,021
Steam	4,693	129	205	77	4,692
Internal Combustion	72	17	62	11	106
Total	**5,803**	**163**	**281**	**102**	**5,819**
1951					
Hydro	1,187	13	28	9	1,193
Steam	5,670	176	124	85	5,533
Internal Combustion	111	29	66	18	130
Total	**6,968**	**218**	**218**	**112**	**6,856**
1952					
Hydro	1,460	14	116	11	1,551
Steam	4,892	142	316	252	4,814
Internal Combustion	105	43	45	21	86
Total	**6,457**	**199**	**477**	**284**	**6,451**
1953					
Hydro	1,632	21	24	9	1,626
Steam	7,803	221	129	155	7,556
Internal Combustion	86	34	46	4	94
Total	**9,521**	**276**	**199**	**168**	**9,276**
1954					
Hydro	1,148	19	67	30	1,166
Steam	10,287	450	211	181	9,867
Internal Combustion	97	39	38	39	57
Total	**11,532**	**508**	**316**	**250**	**11,090**
1955					
Hydro	1,500	24	331	13	1,794
Steam	10,383	587	353	139	10,010
Internal Combustion	87	47	44	8	76
Total	**11,970**	**658**	**728**	**160**	**11,880**
1956					
Hydro	918	253	...	103	562
Steam	5,288	276	356	17	5,351
Internal Combusion	69	22	9	6	50
Total	**6,275**	**551**	**365**	**126**	**5,963**
1957					
Hydro	1,294	13	105	4	1,382
Steam	6,648	301	652	48	6,951
Internal Combustion	97	31	32	5	93
Total	**8,039**	**345**	**789**	**57**	**8,426**
1958†					
Hydro	2,353	11	9	24	2,327
Steam	10,818	449	555	31	10,893
Internal Combustion	75	31	28	2	70
Total	**13,246**	**491**	**592**	**57**	**13,290**

Source: Edison Electric Institute and Federal Power Commission. † Preliminary. * Adjustments are result of reclassification in ownership between industrial and electric utility plants and rerating of turbines within the electric utility industry.

Number and Installed Capacity of Electric Utility Generating Plants By States and Type of Prime Mover — Kw

December 31, 1958 (Preliminary)

	Number of Utilities[a]	Number of Plants[b]	Total Capacity (Kilowatts)	Hydro		Steam		Internal Combustion	
				Number	Capacity	Number	Capacity	Number	Capacity
UNITED STATES	**1,344**	**3,517**	**142,413,158**	**1,362**	**29,362,614**	**1,055**	**110,434,987**	**1,100**	**2,615,557**
New England	**84**	**306**	**6,308,562**	**195**	**1,257,838**	**76**	**4,940,019**	**35**	**110,705**
Maine	19	86	742,378	58	351,533	11	349,150	17	41,695
New Hampshire	11	42	663,290	35	398,524	6	261,750	1	3,016
Vermont	12	69	262,175	54	187,080	8	58,650	7	16,445
Massachusetts	26	67	2,590,212	30	186,056	30	2,372,154	7	32,002
Rhode Island	6	10	422,847	3	2,475	5	409,825	2	10,547
Connecticut	10	32	1,627,660	15	132,170	16	1,488,490	1	7,000
Middle Atlantic	**79**	**294**	**21,417,331**	**152**	**2,032,806**	**118**	**19,312,241**	**24**	**72,284**
New York	41	197	10,010,513	141	1,594,681	42	8,368,800	14	47,032
New Jersey	10	20	3,617,886	2	6,080	16	3,606,624	2	5,182
Pennsylvania	28	77	7,788,932	9	432,045	60	7,336,817	8	20,070
East North Central	**254**	**604**	**31,761,052**	**245**	**839,997**	**214**	**30,520,345**	**145**	**400,710**
Ohio	46	79	9,356,395	4	8,575	57	9,302,522	18	45,298
Indiana	38	66	5,489,086	13	31,970	39	5,417,740	14	39,376
Illinois	51	94	7,802,543	9	38,319	53	7,662,533	32	101,691
Michigan	59	173	6,141,488	98	383,864	34	5,604,625	41	152,999
Wisconsin	60	192	2,971,540	121	377,269	31	2,532,925	40	61,346
West North Central	**436**	**829**	**9,656,105**	**105**	**1,296,075**	**224**	**7,296,031**	**500**	**1,063,999**
Minnesota	79	170	1,947,518	37	155,896	52	1,601,120	81	190,502
Iowa	89	191	1,780,552	22	136,966	47	1,371,421	122	272,165
Missouri	65	99	2,060,642	4	192,600	36	1,723,450	59	144,592
North Dakota	14	45	506,835	1	240,000	19	224,790	25	42,045
South Dakota	33	61	543,324	7	324,496	10	151,750	44	67,078
Nebraska	73	131	1,122,289	30	240,207	22	753,850	79	128,232
Kansas	83	132	1,694,945	4	5,910	38	1,469,650	90	219,385
South Atlantic	**120**	**356**	**19,475,536**	**162**	**3,551,581**	**125**	**15,716,416**	**69**	**207,539**
Delaware	4	7	342,340	.....	.....	5	333,600	2	8,740
Maryland	11	23	1,575,952	3	271,325	13	1,285,000	7	19,627
District of Columbia	2	3	533,000	1	3,000	2	530,000	.....	.....
Virginia	22	62	3,109,158	34	398,130	16	2,682,071	12	28,957
West Virginia	9	32	2,360,429	10	100,880	15	2,256,165	7	3,384
North Carolina	27	83	4,119,297	56	1,207,850	18	2,892,750	9	18,697
South Carolina	12	38	2,072,739	26	937,725	9	1,133,500	3	1,514
Georgia	7	39	2,099,410	27	590,010	11	1,507,400	1	2,000
Florida	26	69	3,263,211	5	42,661	36	3,095,930	28	124,620
East South Central	**37**	**116**	**13,910,753**	**43**	**3,742,080**	**50**	**10,143,885**	**23**	**24,788**
Kentucky	9	24	3,249,032	5	540,860	16	2,699,900	3	8,272
Tennessee	6	39	5,977,298	26	1,910,000	11	4,067,000	2	298
Alabama	4	26	3,974,870	12	1,291,220	11	2,681,250	3	2,400
Mississippi	18	27	709,553	.....	.....	12	695,735	15	13,818
West South Central	**149**	**335**	**12,962,917**	**35**	**944,000**	**120**	**11,560,399**	**180**	**458,518**
Arkansas	16	32	1,179,135	8	388,340	11	757,045	13	33,750
Louisiana	30	62	2,218,568	.....	.....	19	2,093,100	43	125,468
Oklahoma	40	64	1,962,603	3	165,200	23	1,702,084	38	95,319
Texas	63	177	7,602,611	24	390,460	67	7,008,170	86	203,981
Mountain	**133**	**375**	**7,410,090**	**192**	**4,156,049**	**74**	**3,030,655**	**109**	**223,386**
Montana	8	27	1,017,152	19	898,910	5	115,800	3	2,442
Idaho	12	49	1,167,275	44	1,162,885	.....	.....	5	4,390
Wyoming	18	51	247,738	20	155,382	10	78,270	21	14,086
Colorado	36	75	1,088,393	27	247,392	23	797,818	25	43,183
New Mexico	14	31	676,001	3	24,830	13	602,400	15	48,771
Arizona	12	41	1,894,907	12	980,040	13	853,050	16	61,817
Utah	25	84	615,972	57	99,630	9	479,317	18	37,025
Nevada	8	17	702,652	10	586,980	1	104,000	6	11,672
Pacific	**52**	**302**	**19,510,812**	**233**	**11,542,188**	**54**	**7,914,996**	**15**	**53,628**
Washington	19	55	5,596,854	42	5,356,354	8	237,000	5	3,500
Oregon	13	71	2,602,484	53	2,398,197	12	198,710	6	5,577
California	20	176	11,311,474	138	3,787,637	34	7,479,286	4	44,551

NOTES: [a] Total includes 102 duplications because of utilities having generating plants in more than one state.
[b] Each type of prime mover at combination plants is counted as a separate plant

Capacity Additions Reported to Electrical World—Kw†

	1958	1959	1960	1961	After 1961
Hydro					
Power Companies	1,211,003	483,800	608,000	824,500	1,195,500
Municipal, State and Power District Systems	538,000	550,100	1,538,400	1,865,600	2,803,750
Cooperatives	6,775	.....	1,500	4,000	5,000
Federal Agencies	674,875	344,500	728,400	861,600	7,477,950
Total	**2,430,653**	**1,378,400**	**2,876,300**	**3,555,700**	**11,482,200**
Steam					
Power Companies	11,287,660	10,295,105	8,688,205	6,803,800	9,792,125
Municipal, State and Power District Systems	1,122,361	1,469,750	271,150	451,200	1,767,125
Cooperatives	77,000	266,950	209,000	.....	122,500
Federal Agencies	330,000	800,000	500,000	.....	.....
Total	**12,817,021**	**12,831,805**	**9,668,355**	**7,255,000**	**11,681,750**
Internal Combustion					
Power Companies	8,000	10,000	3,000	4,000	6,000
Municipal, State and Power District Systems	26,808	37,920	11,500	15,800	62,050
Cooperatives	1,060	6,800	.....	3,500	.....
Federal Agencies	.....	.....	.....	.....	5,200
Total	**35,868**	**54,720**	**14,500**	**23,300**	**73,250**
Total					
Power Companies	12,506,663	10,788,905	9,299,205	7,632,300	10,993,625
Municipal, State and Power District Systems	1,687,169	2,057,770	1,821,050	2,332,600	4,632,925
Cooperatives	84,835	273,750	210,500	7,500	127,500
Federal Agencies	1,004,875	1,144,500	1,228,400	861,600	7,483,150
Total	**15,283,542**	**14,264,925**	**12,559,155**	**10,834,000**	**23,237,200**

Source: "Electrical World" Surveys. † Maximum rated capability.

Utilities Plan 60,895 Mw of New Capacity

New capacity additions planned by all segments of the industry stand at 60,895 Mw according to Electrical World's latest annual survey. While this is slightly under last year's reported figure of 62,804 Mw, it is significantly encouraging since it does not include 1958's record addition of 15,284 Mw.

Of the total additions now planned, 62% or 37,658 Mw are scheduled for installation by year-end 1961. Additions through 1961 break down as follows: 14,265 Mw or 37.9% in 1959; 12,559 Mw or 33.4% in 1960 and 10,834 Mw or 28.8% in 1961.

Under the lump sum for "after 1961" utilities report planned additions of 23,237 Mw as against 20,251 Mw reported for "after 1960" at this time last year. In addition to being higher than last year's figure, the 1959 total indicates even more long-range planning on the part of utilities than in previous years.

This is evidenced by the fact that of the 23,237 Mw reported, 11,682 Mw or 50.3% is slated for steam units as against 48.5% of last year's total. In contrast, hydro additions add to 11,482 Mw or 49.4% compared with 51.8% last year.

Of the 37,658 Mw to be added through 1961, power companies will install 27,720 Mw or 73.6% compared with 33,291 Mw or 78.2% in the three-year period covered last year.

Municipal, state and power district systems will add 6,211 Mw or 16.5% of the total as against 5,532 or 13.0% of last year's total. Federal agencies will add 3,235 Mw or 8.6% against 3,263 Mw or 7.7% reported in 1958. Cooperatives will add 492 Mw or 1.3% of the total.

Details of this study follow on the next thirteen pages ▶

Capacity Additions Reported to Electrical World—Kw

New England

Power Companies	Prime Mover	Capacity End 1958	1958	1959	1960	1961	After 1961	Total Additions Now Planned
Bangor Hydro Electric	Hydro	39,100						
	Steam	28,000				33,000		33,000
	IC	16,000						
	Total	83,100				33,000		33,000
Boston Edison	Hydro	50						
	Steam	926,360		125,000		125,000		250,000
	Total	926,410		125,000		125,000		250,000
Cambridge Electric Light	Steam	63,000	28,000					
Central Main Power	Hydro	267,879						
	Steam	285,000	50,000					
	IC	6,576						
	Total	559,455	50,000					
Connecticut L & P	Hydro	111,920						
	Steam	655,000	106,000		150,000			150,000
	IC	24,000						
	Total	790,920	106,000		150,000			150,000
Green Mountain Power	Hydro	25,680						
	Steam	37,800						
	IC	4,000				2,000	5,000	7,000
	Total	67,480				2,000	5,000	7,000
Hartford Electric Light	Hydro	9,600						
	Steam	489,240	110,000					
	Total	498,840	110,000					
Holyoke Water Power	Hydro	26,056						
	Steam	42,500			137,500			137,500
	Total	68,556			137,500			137,500
Maine Public Service	Hydro	2,300						
	Steam	19,000				12,600		12,600
	IC	9,100						
	Total	30,400				12,600		12,600
Montaup Electric	Steam	190,000		115,000				115,000
New England Electric System	Hydro	470,224						
	Steam	937,133	156,000				450,000	450,000
	IC	10,000						
	Total	1,417,357	156,000				450,000	450,000

Power Companies	Prime Mover	Capacity End 1958	1958	1959	1960	1961	After 1961	Total Additions Now Planned
Consolidated Edison	Steam	4,070,700	350,000	350,000	255,000	360,000	350,000	1,315,000
Duquesne Light	Steam	1,224,000			165,000			165,000
Jersey Central P & L	Steam	485,224	138,000					
Long Island Lighting	Steam	930,100	185,000		185,000		185,000	370,000
Luzerne Electric	Steam	67,000		44,000				44,000
Metropolitan Edison	Hydro	19,620						
	Steam	601,500	165,000				250,000	250,000
	Total	621,120	165,000				250,000	250,000
New Jersey P & L	Hydro					150,000	112,500	262,500
	Steam	128,000						
	Total	128,000				150,000	112,500	262,500
New York State E & G	Hydro	45,705						
	Steam	737,750	142,000					
	IC	2,968						
	Total	786,423	142,000					
Niagara Mohawk	Hydro	869,307	445	17,300				17,300
	Steam	2,285,000	215,000	210,000	210,000			420,000
	Total	3,154,307	215,445	227,300	210,000			437,300
Orange & Rockland Utilities	Hydro	43,750						
	Steam	124,650					125,000	125,000
	Total	168,400					125,000	125,000
Pennsylvania Electric	Hydro	52,700						
	Steam	882,304		370,000				370,000
	Total	935,004		370,000				370,000
Pennsylvania Power	Steam	263,000	90,000					
Pennsylvania Power & Light	Hydro	149,800						
	Steam	1,136,750				300,000		300,000
	Total	1,286,550				300,000		300,000
Philadelphia Electric	Hydro	252,000						
	Steam	2,460,250	185,000	325,000	325,000			650,000
	IC			6,000				6,000
	Total	2,712,250	185,000	331,000	325,000			656,000
Public Service E & G	Steam	2,554,300		580,000	320,000	320,000	320,000	1,540,000
Rochester G & E	Hydro	47,390						
	Steam	328,100		83,500				83,500
	Total	375,490		83,500				83,500

	IC	10,000	.....	.....	.....	.....	.....	.....
	Total	1,417,357	156,000	.....	.....	.....	450,000	450,000
	Steam	328,100	.....	83,500	.....	.....	.....	83,500
	Total	375,490	.....	83,500	.....	.....	.....	83,500

	Prime Mover	Capacity End 1958	1958	1959	1960	1961	After 1961	Total Additions Now Planned
New England Gas & Electric	Steam	222,250	25,000	.....	.....	.....	66,000	66,000
	IC	2,527	.....	.....	.....	.....	.....	.....
	Total	224,777	25,000	.....	.....	.....	66,000	66,000
Public Service Co of New Hampshire	Hydro	73,710	.....	.....	.....	.....	.....	.....
	Steam	261,750	.....	.....	100,000	.....	.....	100,000
	IC	3,000	.....	.....	.....	.....	.....	.....
	Total	338,460	.....	.....	100,000	.....	.....	100,000
United Illuminating	Steam	356,000	.....	.....	.....	160,000	.....	160,000
Yankee Atomic Electric	Steam	.....	.....	.....	134,000	.....	.....	134,000
Total	**Hydro**	**1,026,519**	.....	.....	.....	.....	.....	.....
	Steam	**4,513,033**	**475,000**	**240,000**	**521,500**	**330,600**	**516,000**	**1,608,100**
	IC	**75,203**	.....	.....	.....	**2,000**	**5,000**	**7,000**
	Total	**5,614,755**	**475,000**	**240,000**	**521,500**	**332,600**	**521,000**	**1,615,100**
Municipal, State and Power District Systems								
Braintree, Mass	Steam	20,000	.....	12,500	.....	.....	.....	12,500
Burlington, Vt	Steam	30,000	.....	.....	.....	.....	22,000	22,000
Hudson, Mass	IC	11,566	.....	.....	.....	.....	5,000	5,000
Taunton, Mass	Steam	50,500	16,500	.....	.....	.....	.....	.....
Wallingford, Conn	Steam	22,500	.....	.....	.....	.....	44,000	44,000
Total	**Steam**	**123,000**	**16,500**	**12,500**	.....	.....	**66,000**	**78,500**
	IC	**11,566**	.....	.....	.....	.....	**5,000**	**5,000**
	Total	**134,566**	**16,500**	**12,500**	.....	.....	**71,000**	**83,500**
New England	**Hydro**	**1,026,519**	.....	.....	.....	.....	.....	.....
Total All Agencies	**Steam**	**4,636,033**	**491,500**	**252,500**	**521,500**	**330,600**	**582,000**	**1,686,600**
	IC	**86,769**	.....	.....	.....	**2,000**	**10,000**	**12,000**
	Total	**5,749,321**	**491,500**	**252,500**	**521,500**	**332,600**	**592,000**	**1,698,600**

Middle Atlantic

Power Companies	Prime Mover	Capacity End 1958	1958	1959	1960	1961	After 1961	Total Addition Now Planneds
Atlantic City Electric	Steam	410,500	79,000	.....	.....	.....	125,000	125,000
	IC	500	500	.....	.....	.....	.....	.....
	Total	411,000	79,500	.....	.....	.....	125,000	125,000
Central Hudson G&E	Hydro	47,020	.....	.....	.....	.....	.....	.....
	Steam	132,000	.....	138,000	.....	.....	138,000	276,000
	Total	179,020	.....	138,000	.....	.....	138,000	276,000
West Penn Power	Hydro	50,000	.....	.....	.....	.....	.....	.....
	Steam	1,009,625	165,000	165,000	.....	.....	.....	165,000
	Total	1,059,625	165,000	165,000	.....	.....	.....	165,000
Total	**Hydro**	**1,577,292**	**445**	**17,300**	.....	**150,000**	**112,500**	**279,800**
	Steam	**19,830,753**	**1,714,000**	**2,265,500**	**1,460,000**	**980,000**	**1,493,000**	**6,198,500**
	IC	**3,468**	**500**	**6,000**	.....	.....	.....	**6,000**
	Total	**21,411,513**	**1,714,945**	**2,288,800**	**1,460,000**	**1,130,000**	**1,605,500**	**6,484,300**
Municipal, State and Power District Systems								
Grove City, Pa	IC	6,045	.....	1,250	.....	.....	1,250	2,500
Lansdale, Pa	Steam	13,000	.....	12,500	.....	.....	.....	12,500
N. Y. State Power Authority	Hydro	513,000	513,000	389,000	300,000	1,340,000	555,000	2,584,000
Quakertown, Pa	Steam	6,000	.....	.....	.....	.....	.....	.....
	IC	2,150	.....	2,000	.....	.....	.....	2,000
	Total	8,150	.....	2,000	.....	.....	.....	2,000
Rockville Center, N. Y.	IC	15,148	.....	3,200	.....	3,200	.....	6,400
Vineland, N. J.	Steam	36,000	.....	.....	16,500	.....	.....	16,500
Total	**Hydro**	**513,000**	**513,000**	**389,000**	**300,000**	**1,340,000**	**555,000**	**2,584,000**
	Steam	**55,000**	.....	**12,500**	**16,500**	.....	.....	**29,000**
	IC	**23,343**	.....	**6,450**	.....	**3,200**	**1,250**	**10,900**
	Total	**591,343**	**513,000**	**407,950**	**316,500**	**1,343,200**	**556,250**	**2,623,900**
Middle Atlantic	**Hydro**	**2,090,292**	**513,445**	**406,300**	**300,000**	**1,490,000**	**667,500**	**2,863,800**
Total All Agencies	**Steam**	**19,885,753**	**1,714,000**	**2,278,000**	**1,476,500**	**980,000**	**1,493,000**	**6,227,500**
	IC	**26,811**	**500**	**12,450**	.....	**3,200**	**1,250**	**16,900**
	Total	**22,002,856**	**2,227,945**	**2,696,750**	**1,776,500**	**2,473,200**	**2,161,750**	**9,108,200**

East North Central

Power Companies	Prime Mover	Capacity End 1958	1958	1959	1960	1961	After 1961	Total Additions Now Planned
Central Illinois E & G	Hydro	1,200	.....	.....	.....	.....	.....	.....
	Steam	161,750	.....	.....	.....	55,000	.....	55,000
	IC	750	.....	.....	.....	.....	.....	.....
	Total	163,700	.....	.....	.....	55,000	.....	55,000
Central Illinois Light	Steam	326,400	100,000	.....	125,000	.....	.....	125,000
	IC	2,100	.....	.....	.....	.....	.....	.....
	Total	328,500	100,000	.....	125,000	.....	.....	125,000
Central Illinois P S	Steam	480,000	.....	.....	200,000	.....	.....	200,000

	Prime Mover	Capacity End 1958	1958	1959	1960	1961	After 1961	Total Additions Now Planned
Cincinnati G & E	Steam	1,067,000	172,000		172,000			172,000
Cleveland Electric Illuminating	Steam	1,810,000	250,000	250,000			335,000	585,000
Columbus & Southern Ohio	Steam	665,000	125,000	125,000				125,000
Commonwealth Edison	Hydro	5,375						
	Steam	4,827,667	835,000	305,000	180,000	305,000		790,000
	IC	1,000						
	Total	4,834,042	835,000	305,000	180,000	305,000		790,000
Consumers Power	Hydro	150,940						
	Steam	1,855,100	156,000	250,000		250,000	500,000	1,000,000
	IC	6,498						
	Total	2,012,538	156,000	250,000		250,000	500,000	1,000,000
Dayton P & L	Steam	640,000	130,000	130,000				130,000
Detroit Edison	Hydro	7,850						
	Steam	3,166,500	321,500	325,000	150,000	325,000		800,000
	Total	3,174,350	321,500	325,000	150,000	325,000		800,000
Edison Sault Electric	IC	7,662	2,000	2,000	2,000	2,000		6,000
Illinois Power	Hydro	2,024						
	Steam	645,880		225,000				225,000
	IC	2,000						
	Total	649,904		225,000				225,000
Indiana & Michigan Electric	Hydro	23,504						
	Steam	954,500		450,000				450,000
	Total	978,004		450,000				450,000
Indianapolis P & L	Steam	696,000	108,000			108,000		108,000
Lake Superior District Power	Hydro	12,768						
	Steam	80,000					33,000	33,000
	IC	4,000						
	Total	96,768					33,000	33,000
Madison G & E	Steam	129,000				44,000		44,000
Northern Indiana P S	Hydro	19,005						
	Steam	346,130		276,200				276,200
	Total	365,135		276,200				276,200
Northern States Power	Hydro	159,480	5,400					
	Steam	54,500						
	IC	9,000						
	Total	222,980	5,400					
Ohio Edison	Hydro	1,950						
	Steam	1,515,350		170,000	170,000	170,000	170,000	680,000
	Total	1,517,300		170,000	170,000	170,000	170,000	680,000

	Prime Mover	Capacity End 1958	1958	1959	1960	1961	After 1961	Total Additions Now Planned
Greenfield, Ohio	Steam	3,550				4,000		4,000
Hamilton, Ohio	Steam	33,500			22,000			22,000
Highland, Ill	Steam	6,500		6,000				6,000
Kaukauna, Wis	Hydro	16,100					12,000	12,000
	Steam	3,500						
	Total	19,600					12,000	12,000
Lansing, Mich	Hydro	1,200						
	Steam	227,250	44,000			44,000		44,000
	Total	228,450	44,000			44,000		44,000
Logansport, Ind	Steam	32,000	18,000					
Manitowoc, Wis	Steam	52,000				22,000		22,000
Menasha, Wis	Steam	15,500					15,000	15,000
	IC	850						
	Total	16,350					15,000	15,000
Niles, Mich	Hydro	460						
	IC						3,000	3,000
	Total	460					3,000	3,000
Oberlin, Ohio	IC	7,829	2,500			2,500		2,500
Orrville, Ohio	Steam	16,500			16,500			16,500
Peru, Ill	Steam	8,000		7,500				7,500
Peru, Ind	Steam	19,500		22,000				22,000
Petoskey, Mich	Hydro	870					1,000	1,000
	IC	5,750						
	Total	6,620					1,000	1,000
Piqua, Ohio	Steam	33,000			20,000		20,000	40,000
Rantoul, Ill	IC	6,432		1,750				1,750
Reading, Ohio	Steam	13,000	7,500					
South Haven, Mich	Steam	17,500	7,500				11,500	11,500
Springfield, Ill	Steam	80,000			33,000			33,000
Tipp City, Ohio	Steam	1,500						
	IC	2,480		1,500				1,500
	Total	3,980		1,500				1,500
Winnetka, Ill	Steam	15,500			10,000			10,000
Woodstock, Ill	Steam	14,000				11,500		11,500
	IC	2,910						
	Total	16,910				11,500		11,500

	Steam	1,515,350	.....	170,000	170,000	170,000	170,000	680,000
	Total	1,517,300	.....	170,000	170,000	170,000	170,000	680,000

	IC	2,910	.....	.....	.....	.....	11,500	.....	11,500
	Total	16,910	.....	.....	.....	.....	11,500	.....	11,500

	Prime Mover	Capacity End 1958	1958	1959	1960	1961	After 1961	Total Additions Now Planned
Ohio Power	Hydro	3,000	.....	.....	.....	.....	.....	.....
	Steam	1,640,722	225,000	.....	.....	.....	.....	.....
	Total	1,643,722	225,000	.....	.....	.....	.....	.....
Public Service Co. of Indiana	Steam	1,133,500	150,000	150,000	300,000	.....	.....	450,000
Toledo Edison	Hydro	5,000	.....	.....	.....	.....	.....	.....
	Steam	511,625	.....	140,625	.....	.....	140,625	281,250
	Total	516,625	.....	140,625	.....	.....	140,625	281,250
Upper Peninsula Power Co.	Hydro	14,000	.....	.....	.....	.....	.....	.....
	Steam	53,200	25,200	15,625	.....	.....	.....	15,625
	Total	67,200	25,200	15,625	.....	.....	.....	15,625
Wisconsin Electric Power	Hydro	240	.....	.....	.....	.....	.....	.....
	Steam	1,317,500	.....	250,000	.....	.....	250,000	500,000
	Total	1,317,740	.....	250,000	.....	.....	250,000	500,000
Wisconsin P & L	Hydro	42,000	.....	.....	.....	.....	.....	.....
	Steam	327,200	.....	100,000	.....	.....	100,000	200,000
	Total	369,200	.....	100,000	.....	.....	100,000	200,000
Wisconsin Public Service	Hydro	63,296	.....	.....	.....	.....	.....	.....
	Steam	337,500	75,000	.....	75,000	.....	.....	75,000
	IC	3,000	.....	.....	.....	.....	.....	.....
	Total	403,796	75,000	.....	75,000	.....	.....	75,000
Total	**Hydro**	**511,632**	**5,400**	.....	.....	.....	.....	.....
	Steam	**24,742,024**	**2,672,700**	**3,162,450**	**1,372,000**	**1,257,000**	**1,528,625**	**7,320,075**
	IC	**36,010**	**2,000**	**2,000**	**2,000**	**2,000**	.....	**6,000**
	Total	**25,289,666**	**2,680,100**	**3,164,450**	**1,374,000**	**1,259.000**	**1,528,625**	**7,326,075**
Municipal, State and Power District Systems								
Bluffton, Ind	IC	7,000	.....	3,000	.....	.....	.....	3,000
Breese, Ill	Steam	1,300	.....	2,000	.....	.....	.....	2,000
	IC	900	.....	.....	.....	.....	.....	.....
	Total	2,200	.....	2,000	.....	.....	.....	2,000
Bryan, Ohio	IC	6,750	.....	.....	.....	5,000	10,000	15,000
Cedarburg, Wis	IC	3,500	.....	.....	3,000	.....	.....	3,000
Deshler, Ohio	IC	2,566	223	1,400	.....	.....	.....	1,400
Detroit, Mich	Steam	170,000	50,000	.....	.....	.....	40,000	40,000
Dover, Ohio	Steam	17,750	.....	.....	.....	10,000	.....	10,000
Dowagiac, Mich	IC	3,389	.....	.....	.....	2,000	.....	2,000
Escanaba, Mich	Steam	25,300	25,300	.....	.....	.....	15,000	15,000
Grayling, Mich	IC	2,550	700	.....	.....	.....	1,000	1,000

	Prime Mover	Capacity End 1958	1958	1959	1960	1961	After 1961	Total Additions Now Planned
Wyandotte, Mich	Steam	23,500	.....	22,500	.....	.....	.....	22,500
Zeeland, Mich	IC	6,638	2,000	.....	.....	.....	2,500	2,500
Total	**Hydro**	**18,630**	.....	.....	.....	.....	**13,000**	**13,000**
	Steam	**830,150**	**152,300**	**60,000**	**101,500**	**91,500**	**101,500**	**354,500**
	IC	**59,544**	**5,423**	**7,650**	**3,000**	**9,500**	**16,500**	**36,650**
	Total	**908,324**	**157,723**	**67,650**	**104,500**	**101,000**	**131,000**	**404,150**
Cooperatives								
Dairyland Power	Hydro	21,600	.....	.....	.....	.....	.....	.....
	Steam	178,750	.....	80,000	.....	.....	.....	80,000
	IC	13,500	.....	.....	.....	.....	.....	.....
	Total	213,850	.....	80,000	.....	.....	.....	80,000
Northern Michigan Electric	Hydro	1,760	.....	.....	.....	.....	.....	.....
	Steam	15,000	.....	.....	.....	.....	15,000	15,000
	IC	4,109	.....	100	.....	.....	.....	100
	Total	20,869	.....	100	.....	.....	15,000	15,100
Pioneer Rural Electric	Steam	.....	.....	.....	22,000	.....	.....	22,000
Washington Island Electric	IC	570	.....	200	.....	.....	200	400
Wolverine Electric	IC	18,400	.....	6,500	.....	3,500	.....	10,000
Total	**Hydro**	**23,360**	.....	.....	.....	.....	.....	.....
	Steam	**193,750**	.....	**80,000**	**22,000**	.....	**15,000**	**117,000**
	IC	**36,579**	.....	**6,800**	.....	**3,500**	**200**	**10,500**
	Total	**253,689**	.....	**86,800**	**22,000**	**3,500**	**15,200**	**127,500**
East North Central	**Hydro**	**553,622**	**5,400**	.....	.....	.....	**13,000**	**13,000**
Total All Agencies	**Steam**	**25,765,924**	**2,825,000**	**3,302,450**	**1,495,500**	**1,348,500**	**1,645,125**	**7,791,575**
	IC	**132,133**	**7,423**	**16,450**	**5,000**	**15,000**	**16,700**	**53,150**
	Total	**26,451,679**	**2,837,823**	**3,318,900**	**1,500,500**	**1,363,500**	**1,674,825**	**7,857,725**

West North Central

Power Companies	Prime Mover	Capacity End 1958	1958	1959	1960	1961	After 1961	Total Additions Now Planned
Black Hills P & L	Hydro	1,346	.....	.....	.....	.....	.....	.....
	Steam	80,500	.....	.....	.....	24,200	.....	24,200
	IC	8,313	.....	.....	.....	.....	.....	.....
	Total	90,159	.....	.....	.....	24,200	.....	24,200

	Prime Mover	Capacity End 1958	1958	1959	1960	1961	After 1961	Total Additions Now Planned
Central E & G	Hydro	200						
	IC	6,335		1,000			1,000	2,000
	Total	6,535		1,000			1,000	2,000
Central Kansas Power	Steam	44,650		23,000			48,000	71,000
	IC	5,535						
	Total	50,185		23,000			48,000	71,000
Empire District Electric	Hydro	19,000						
	Steam	147,000					66,000	66,000
	Total	166,000					66,000	66,000
Interstate Power	Hydro	3,242						
	Steam	206,750		30,000				30,000
	IC	4,035						
	Total	214,027		30,000				30,000
Iowa Electric L & P	Hydro	4,053						
	Steam	197,500				75,000		75,000
	IC	49,207						
	Total	250,760				75,000		75,000
Iowa-Illinois G & E	Hydro	4,000						
	Steam	240,079				125,000		125,000
	IC	1,000						
	Total	245,079				125,000		125,000
Iowa Power & Light Co	Hydro	400						
	Steam	351,750	82,000				125,000	125,000
	IC	10,348						
	Total	362,498	82,000				125,000	125,000
Iowa Public Service	Hydro	2,051						
	Steam	213,800	50,000					
	IC	29,295						
	Total	245,146	50,000					
Kansas City P & L	Steam	816,000	156,250		156,250		156,250	312,500
Kansas G & E	Steam	423,000		116,000		160,000		276,000
Kansas P & L	Hydro	1,060						
	Steam	410,000			125,000			125,000
	IC	2,958						
	Total	414,018			125,000			125,000
Minnesota P & L	Hydro	106,665						
	Steam	294,000	63,950	63,950				63,950
	Total	400,665	63,950	63,950				63,950
Missouri P & L	Steam	48,200						
	IC	4,500	500					
	Total	52,700	500					

	Prime Mover	Capacity End 1958	1958	1959	1960	1961	After 1961	Total Additions Now Planned
Consumers Public Power District	Hydro	8,940						
	Steam	25,125					109,375	109,375
	IC	14,779						
	Total	48,844					109,375	109,375
Coon Rapids, Iowa	IC	3,425					1,800	1,800
Elk River, Minn	Hydro	230						
	IC	1,100			2,000			2,000
	Total	1,330			2,000			2,000
Fairmont, Minn	Steam	12,000		12,500				12,500
Fosston, Minn	IC	954					1,500	1,500
Fremont, Neb	Steam	37,500	16,500				66,000	66,000
Fulton, Mo	Steam	7,500	7,500					
Horton, Kan	IC	2,065		500			500	1,000
Independence, Mo	Steam	51,500	44,000					
Iola, Kan	Steam	10,500	6,000					
Kansas City, Kan	Steam	194,000				60,000		60,000
Kennett, Mo	IC	7,556		2,500				2,500
Kimball, Neb	IC	3,770		1,200				1,200
Lake Park, Iowa	IC	1,900	800				500	500
Macon, Mo	Steam	6,000	3,500					
McPherson, Kan	Steam	27,000					33,000	33,000
	IC	1,000						
	Total	28,000					33,000	33,000
Moorhead, Minn	Steam	14,250						
	IC			10,000				10,000
	Total	14,250		10,000				10,000
Muscatine, Iowa	Steam	27,000		25,000				25,000
	IC	250						
	Total	27,250		25,000				25,000
Nebraska Public Power System	Hydro	129,601						
	Steam	246,500	100,000				150,000	150,000
	IC	2,976						
	Total	379,077	100,000				150,000	150,000
New Ulm, Minn	Steam	15,000					10,000	10,000
North Branch, Minn	IC	648		700				700
Norton, Kan	IC	2,340			1,000		2,000	3,000

	Prime Mover	Capacity End 1958	1958	1959	1960	1961	After 1961	Total Additions Now Planned
Missouri, P S	Hydro	1,600	.....	.....	.....	.....	.....	.....
	Steam	71,000	24,500	.....	45,500	45,500	.....	91,000
	IC	4,413	.....	.....	.....	.....	.....	.....
	Total	77,013	24,500	.....	45,500	45,500	.....	91,000
Montana- Dakota Utilities	Steam	130,600	44,000	.....	.....	.....	.....	.....
	IC	17,750	.....	.....	.....	.....	.....	.....
	Total	148,350	44,000	.....	.....	.....	.....	.....
Northern States Power...	Hydro	39,070	.....	.....	.....	.....	.....	.....
	Steam	1,062,300	.....	172,000	172,000	.....	66,000	410,000
	IC	30,415	.....	.....	.....	.....	.....	.....
	Total	1,131,785	.....	172,000	172,000	.....	66,000	410,000
Otter Tail Power.....	Hydro	5,745	.....	.....	.....	.....	.....	.....
	Steam	94,000	.....	53,500	.....	.....	50,000	103,500
	IC	23,725	.....	.....	.....	.....	.....	.....
	Total	123,470	.....	53,500	.....	.....	50,000	103,500
St. Joseph L & P.....	Steam	91,000	.....	.....	.....	.....	33,000	33,000
	IC	2,205	.....	.....	.....	.....	.....	.....
	Total	93,205	.....	.....	.....	.....	33,000	33,000
Union Electric.....	Hydro	293,600	.....	.....	.....	.....	.....	.....
	Steam	1,480,000	250,000	.....	.....	300,000	300,000	600,000
	Total	1,773,600	250,000	.....	.....	300,000	300,000	600,000
Western Light & Telephone	Steam	76,350	.....	.....	.....	.....	50,000	50,000
	IC	19,241	.....	.....	.....	.....	.....	.....
	Total	95,591	.....	.....	.....	.....	50,000	50,000
Total	**Hydro**	**482,032**	.....	.....	.....	.....	.....	.....
	Steam	**6,478,479**	**670,700**	**458,450**	**498,750**	**729,700**	**894,250**	**2,581,150**
	IC	**219,275**	**500**	**1,000**	.....	.....	**1,000**	**2,000**
	Total	**7,179,786**	**671,200**	**459,450**	**498,750**	**729,700**	**895,250**	**2,583,150**
Municipal, State and Power District Systems								
Aitkin, Minn.....	IC	3,000	.....	.....	.....	.....	1,500	1,500
Ames, Iowa.....	Steam	28,150	12,650	.....	.....	.....	.....	.....
	IC	1,000	.....	.....	.....	.....	.....	.....
	Total	29,150	12,650	.....	.....	.....	.....	.....
Atlantic, Iowa.....	Steam	11,250	.....	.....	.....	.....	7,500	7,500
Auburn, Neb.....	Hydro	4,850	.....	1,100	1,100	.....	1,100	3,300
Austin, Minn.....	Steam	26,000	5,500	.....	.....	.....	18,750	18,750
Carthage, Mo.....	IC	15,080	.....	.....	.....	.....	6,000	6,000
Chanute, Kan.....	Steam	17,500	7,500	.....	.....	.....	.....	.....
	IC	1,500	.....	.....	.....	.....	.....	.....
	Total	19,000	7,500	.....	.....	.....	.....	.....
Columbia, Mo.....	Steam	35,000	.....	.....	.....	.....	22,000	22,000
Omaha Public Power District	Steam	364,000	.....	108,000	.....	.....	.....	108,000
Osborne, Kan.....	IC	3,025	1,135	.....	.....	.....	.....	.....
Poplar Bluff, Mo.....	Steam	6,500	.....	7,500	.....	.....	.....	7,500
Red Cloud, Neb.....	IC	1,925	.....	.....	.....	1,900	.....	1,900
Rochester, Minn.....	Hydro	1,840	.....	.....	.....	.....	.....	.....
	Steam	31,500	.....	.....	.....	.....	20,000	20,000
	Total	33,340	.....	.....	.....	.....	20,000	20,000
Sanborn, Iowa.....	IC	1,450	.....	.....	.....	.....	1,500	1,500
Schuyler, Neb.....	Steam	9,000	5,000	.....	.....	.....	.....	.....
Sikeston, Mo.....	Steam	.....	.....	6,250	.....	.....	.....	6,250
	IC	2,700	.....	.....	.....	.....	.....	.....
	Total	2,700	.....	6,250	.....	.....	.....	6,250
Spencer, Iowa.....	Steam	10,000	.....	.....	7,500	.....	.....	7,500
Springfield, Mo.....	Steam	67,500	.....	44,000	.....	.....	66,000	110,000
St. Francis, Kan.....	IC	1,950	1,950	810	.....	.....	.....	810
Stockton, Kan.....	IC	2,827	.....	.....	.....	.....	1,000	1,000
Sumner, Iowa.....	IC	3,035	.....	.....	.....	.....	1,500	1,500
Valley City, N. Dak.....	Steam	5,000	.....	.....	.....	.....	7,500	7,500
Virginia, Minn.....	Steam	17,500	.....	.....	.....	.....	10,000	10,000
Watertown, S. Dak.....	Steam	8,000	.....	.....	.....	.....	10,000	10,000
Waverly, Ia.....	Hydro	495	.....	.....	.....	.....	.....	.....
	IC	8,945	3,500	.....	.....	.....	5,000	5,000
	Total	9,440	3,500	.....	.....	.....	5,000	5,000
Webster City, Iowa.....	Steam	7,875	.....	7,500	.....	.....	.....	7,500
Wells, Minn.....	IC	3,856	.....	2,000	.....	.....	.....	2,000
West Point, Neb.....	IC	1,865	.....	1,250	.....	.....	.....	1,250
Wilton Junction, Iowa.....	IC	1,000	1,000	.....	.....	.....	.....	.....
Total	**Hydro**	**145,956**	.....	**1,100**	**1,100**	.....	**1,100**	**3,300**
	Steam	**1,318,650**	**208,150**	**210,750**	**7,500**	**60,000**	**530,125**	**808,375**
	IC	**95,921**	**8,385**	**18,960**	**3,000**	**1,900**	**22,800**	**46,660**
	Total	**1,560,527**	**216,535**	**230,810**	**11,600**	**61,900**	**554,025**	**858,335**
Cooperatives								
Central Iowa Power.....	Steam	88,000	44,000	.....	.....	.....	.....	.....

	Prime Mover	Capacity End 1958	1958	1959	1960	1961	After 1961	Total Additions Now Planned
Central Kansas Electric...	Steam	.....	.....	.....	.....	.....	16,500	16,500
	IC	10,520	.....	.....	.....	.....	5,000	5,000
	Total	10,520	.....	.....	.....	.....	21,500	21,500
Corn Belt Power.....	Steam	46,500	.....	.....	33,000	.....	33,000	66,000
	IC	24,100	.....	.....	.....	.....	.....	.....
	Total	70,600	.....	.....	33,000	.....	33,000	66,000
Eastern Iowa L & P.....	Steam	.....	.....	22,000	.....	.....	22,000	44,000
Northeast Missouri E P C..	Steam	15,000	.....	.....	.....	.....	3,000	3,000
	IC	7,440	.....	.....	.....	.....	.....	.....
	Total	22,440	.....	.....	.....	.....	3,000	3,000
Rural Cooperative Power Ass'n.	Steam	27,000	.....	.....	22,000	.....	.....	22,000
	IC	20,670	.....	.....	.....	.....	.....	.....
	Total	47,670	.....	.....	22,000	.....	.....	22,000
Total.....	**Steam**	**176,500**	**44,000**	**22,000**	**55,000**	.....	**74,500**	**151,500**
	IC	**62,730**	.....	.....	.....	.....	**5,000**	**5,000**
	Total	**239,230**	**44,000**	**22,000**	**55,000**	.....	**79,500**	**156,500**
Federal Agencies								
Corps of Engineers.....	Hydro	240,000	.....	.....	160,000	.....	595,000	755,000
Total.....	**Hydro**	**240,000**	.....	.....	**160,000**	.....	**595,000**	**755,000**
West North Central	**Hydro**	**867,988**	.....	**1,100**	**161,100**	.....	**596,100**	**758,300**
Total All Agencies	**Steam**	**7,973,629**	**922,850**	**691,200**	**561,250**	**789,700**	**1,498,875**	**3,541,025**
	IC	**377,926**	**8,885**	**19,960**	**3,000**	**1,900**	**28,800**	**53,660**
	Total	**9,219,543**	**931,735**	**712,260**	**725,350**	**791,600**	**2,123,775**	**4,352,985**

South Atlantic

Power Companies	Prime Mover	Capacity End 1958	1958	1959	1960	1961	After 1961	Total Additions Now Planned
Appalachian Power	Hydro	120,277	.....	.....	.....	.....	.....	.....
	Steam	1,990,863	446,000	.....	.....	.....	.....	.....
	IC	612	.....	.....	.....	.....	.....	.....
	Total	2,111,752	446,000	.....	.....	.....	.....	.....
Baltimore G & E...	Steam	955,500	.....	134,000	.....	175,000	.....	309,000
Carolina P & L....	Hydro	205,100	.....	.....	.....	22,000	.....	22,000
	Steam	865,500	174,000	.....	190,000	.....	.....	190,000
	Total	1,070,600	174,000	.....	190,000	22,000	.....	212,000
Delaware P & L....	Steam	411,100	85,000	.....	.....	.....	150,000	150,000
Municipal, State and Power District Systems								
Bedford, Va.....	Hydro	1,000	.....	.....	1,000	.....	.....	1,000
Crisp County Power Commission, Ga.	Hydro	17,000	.....	.....	.....	.....	.....	.....
	Steam	12,500	12,500	.....	.....	.....	.....	.....
	IC	5,000	.....	.....	.....	.....	.....	.....
	Total	34,500	12,500	.....	.....	.....	.....	.....
Fort Pierce, Fla....	Steam	33,000	16,500	.....	.....	.....	.....	.....
Gainesville, Fla....	Steam	37,250	16,500	.....	.....	.....	.....	.....
	IC	1,160	.....	.....	.....	.....	.....	.....
	Total	38,410	16,500	.....	.....	.....	.....	.....
Hagerstown, Md...	Steam	31,300	12,500	.....	.....	.....	.....	.....
	IC	1,000	.....	.....	.....	.....	.....	.....
	Total	32,300	12,500	.....	.....	.....	.....	.....
Jacksonville, Fla....	Steam	375,000	66,000	.....	.....	.....	.....	.....
Key West, Fla.....	Steam	26,500	.....	.....	16,500	.....	.....	16,500
	IC	6,000	.....	.....	.....	.....	.....	.....
	Total	32,500	.....	.....	16,500	.....	.....	16,500
Lakeland, Fla.....	Steam	57,500	.....	25,000	.....	.....	200,000	225,000
Moncks Corner, S.C.	Hydro	134,535	.....	.....	.....	.....	.....	.....
	Steam	88,000	.....	.....	.....	.....	60,000	60,000
	Total	222,535	.....	.....	.....	.....	60,000	60,000
Orlando, Fla.....	Steam	124,500	33,000	90,000	.....	.....	.....	90,000
Tallahassee, Fla....	Steam	71,500	23,500	.....	.....	.....	.....	.....
Total.....	**Hydro**	**152,535**	.....	.....	**1,000**	.....	.....	**1,000**
	Steam	**857,050**	**180,500**	**115,000**	**16,500**	.....	**260,000**	**391,500**
	IC	**13,160**	.....	.....	.....	.....	.....	.....
	Total	**1,022,745**	**180,500**	**115,000**	**17,500**	.....	**260,000**	**392,500**
Cooperatives								
Central Electric Power Coop	Steam	.....	.....	44,000	.....	.....	.....	44,000
Total.....	**Steam**	.....	.....	**44,000**	.....	.....	.....	**44,000**
Federal Agencies								
Corps of Engineers.	Hydro	440,000	.....	.....	.....	.....	366,000	366,000
Total.....	**Hydro**	**440,000**	.....	.....	.....	.....	**366,000**	**366,000**
South Atlantic	**Hydro**	**2,115,240**	.....	**60,000**	**1,000**	**22,000**	**483,000**	**566,000**
Total All Agencies	**Steam**	**16,279,753**	**2,932,410**	**1,523,455**	**1,842,955**	**1,078,500**	**1,360,000**	**5,804,910**
	IC	**40,738**	.....	**1,000**	.....	.....	.....	**1,000**
	Total	**18,435,731**	**2,932,410**	**1,584,455**	**1,843,955**	**1,100,500**	**1,843,000**	**6,371,910**

	Prime Mover	Capacity End 1958	1958	1959	1960	1961	After 1961	Total Additions Now Planned
Duke Power	Hydro	503,753						
	Steam	2,279,000	165,000	275,000	275,000	275,000		825,000
	Total	2,782,753	165,000	275,000	275,000	275,000		825,000
Florida Power	Hydro	12,493						
	Steam	647,000	121,000	75,000		121,000		196,000
	IC	3,328						
	Total	662,821	121,000	75,000		121,000		196,000
Florida P & L	Steam	1,462,000	320,000	160,000	240,000	240,000		640,000
	IC	6,800						
	Total	1,468,800	320,000	160,000	240,000	240,000		640,000
Florida Public Utilities	Hydro	170						
	IC	9,690		1,000				1,000
	Total	9,860		1,000				1,000
Georgia Power	Hydro	357,250		60,000			30,000	90,000
	Steam	1,342,400	125,000	75,000			550,000	625,000
	IC	2,000						
	Total	1,701,650	125,000	135,000			580,000	715,000
Gulf Power	Steam	155,000		75,000		75,000		150,000
Monongahela Power	Steam	430,325			165,000			165,000
	IC	3,798						
	Total	434,123			165,000			165,000
Ohio Power	Steam	455,000		225,000	450,000			675,000
Ormet Generating	Steam	450,000	450,000					
Potomac Edison	Hydro	11,777						
	Steam	328,900	75,000					
	Total	340,677	75,000					
Potomac Electric Power	Steam	960,000		175,000	175,000		200,000	550,000
Savannah Electric & Power	Steam	149,500	55,000			55,000		55,000
South Carolina E & G	Hydro	174,360						
	Steam	532,500	275,000			137,500		137,500
	IC	150						
	Total	707,010	275,000			137,500		137,500
Tampa Electric	Steam	493,500	120,000		161,000			161,000
Virginia Electric & Power	Hydro	137,525					87,000	87,000
	Steam	1,514,615	340,910	170,455	170,455		200,000	540,910
	IC	1,200						
	Total	1,653,340	340,910	170,455	170,455		287,000	627,910
Total	**Hydro**	**1,522,705**		**60,000**		**22,000**	**117,000**	**199,000**
	Steam	**15,422,703**	**2,751,910**	**1,364,455**	**1,826,455**	**1,078,500**	**1,100,000**	**5,369,410**
	IC	**27,578**		**1,000**				**1,000**
	Total	**16,972,986**	**2,751,910**	**1,425,455**	**1,826,455**	**1,100,500**	**1,217,000**	**5,569,410**

East South Central

Power Companies	Prime Mover	Capacity End 1958	1958	1959	1960	1961	After 1961	Total Additions Now Planned
Alabama Power	Hydro	489,700				136,000	530,700	666,700
	Steam	1,211,250	165,000	225,000				225,000
	Total	1,700,950	165,000	225,000		136,000	530,700	891,700
Kentucky Utilities	Hydro	30,540						
	Steam	407,500		100,000				100,000
	Total	438,040		100,000				100,000
Louisville G & E	Hydro	80,320						
	Steam	740,000	125,000				150,000	150,000
	Total	820,320	125,000				150,000	150,000
Mississippi Power	Steam	222,500			75,000		100,000	175,000
Mississippi P & L	Steam	407,000		230,000			150,000	380,000
	IC	3,350						
	Total	410,350		230,000			150,000	380,000
Southern Electric Generating	Steam				480,000	240,000	240,000	960,000
Total	**Hydro**	**600,560**				**136,000**	**530,700**	**666,700**
	Steam	**2,988,250**	**290,000**	**555,000**	**555,000**	**240,000**	**640,000**	**1,990,000**
	IC	**3,350**						
	Total	**3,592,160**	**290,000**	**555,000**	**555,000**	**376,000**	**1,170,700**	**2,656,700**
Municipal, State and Power District Systems								
Clarksdale, Miss	Steam	20,000	7,000			9,700		9,700
Greenwood, Miss	Steam	23,500			12,650			12,650
Memphis, Tenn	Steam	250,000	250,000	500,000				500,000
Total	**Steam**	**293,500**	**257,000**	**500,000**	**12,650**	**9,700**		**522,350**
Cooperatives								
Alabama Electric	Hydro	9,120						
	Steam	33,750		22,500				22,500
	IC	1,760						
	Total	44,630		22,500				22,500
East Kentucky Rural Electric Coop	Steam	172,000			66,000			66,000
Total	**Hydro**	**9,120**						
	Steam	**205,750**		**22,500**	**66,000**			**88,500**
	IC	**1,760**						
	Total	**216,630**		**22,500**	**66,000**			**88,500**

	Prime Mover	Capacity End 1958	1958	1959	1960	1961	After 1961	Total Additions Now Planned
Federal Agencies								
Corps of Engineers...	Hydro	583,000	24,000	12,000	.....	.....	260,000	272,000
Tennessee Valley Authority	Hydro	2,377,900	.....	.....	.....	162,000	.....	162,000
	Steam	6,764,750	330,000	800,000	500,000	.....	.....	1,300,000
	Total	9,142,650	330,000	800,000	500,000	162,000	.....	1,462,000
Total	**Hydro**	**2,960,900**	**24,000**	**12,000**	.....	**162,000**	**260,000**	**434,000**
	Steam	**6,764,750**	**330,000**	**800,000**	**500,000**	.....	.....	**1,300,000**
	Total	**9,725,650**	**354,000**	**812,000**	**500,000**	**162,000**	**260,000**	**1,734,000**
East South Central Total All Agencies	**Hydro**	**3,570,580**	**24,000**	**12,000**	.....	**298,000**	**790,700**	**1,100,700**
	Steam	**10,252,250**	**877,000**	**1,877,500**	**1,133,650**	**249,700**	**640,000**	**3,900,850**
	IC	**5,110**	.....	.....	.....	.....	.....	.....
	Total	**13,827,940**	**901,000**	**1,889,500**	**1,133,650**	**547,700**	**1,430,700**	**5,001,550**

West South Central

Power Companies	Prime Mover	Capacity End 1958	1958	1959	1960	1961	After 1961	Total Additions Now Planned
Arkansas Power & Light	Hydro	65,300	.....	.....	.....	.....	.....	.....
	Steam	708,750	.....	.....	.....	325,000	.....	325,000
	IC	182	.....	.....	.....	.....	.....	.....
	Total	774,232	.....	.....	.....	325,000	.....	325,000
Central Louisana Electric	Steam	170,000	55,000	.....	.....	100,000	.....	100,000
	IC	17,811	.....	.....	.....	.....	.....	.....
	Total	187,811	55,000	.....	.....	100,000	.....	100,000
Central P & L.....	Hydro	10,000	.....	.....	.....	.....	.....	.....
	Steam	590,900	75,000	175,000	110,000	.....	175,000	460,000
	IC	900	.....	.....	.....	.....	.....	.....
	Total	601,800	75,000	175,000	110,000	.....	175,000	460,000
Dallas P & L.....	Steam	838,850	125,000	.....	175,000	.....	175,000	350,000
El Paso Electric.....	Steam	231,800	51,000	.....	80,000	.....	.....	80,000
Gulf States Utilities.	Steam	874,400	111,000	222,000	324,000	.....	660,000	1,206,000
Houston L & P.....	Steam	1,706,000	378,500	376,250	440,000	275,000	350,000	1,441,250
Louisiana P & L....	Steam	631,750	210,000	.....	.....	223,000	.....	223,000
New Orleans P S..	Steam	528,000	.....	.....	.....	.....	220,000	220,000
Jonesboro, Ark.....	Steam	35,150	12,650	.....	.....	.....	15,000	15,000
	IC	1,000	.....	.....	.....	.....	.....	.....
	Total	36,150	12,650	.....	.....	.....	15,000	15,000
Lafayette, La.....	Steam	20,650	.....	22,000	.....	.....	.....	22,000
	IC	4,450	.....	.....	.....	.....	.....	.....
	Total	25,100	.....	22,000	.....	.....	.....	22,000
Lubbock, Texas.....	Steam	74,500	22,000	.....	.....	.....	44,000	44,000
	IC	14,150	.....	.....	.....	.....	.....	.....
	Total	88,650	22,000	.....	.....	.....	44,000	44,000
Monroe, La.....	Steam	34,500	.....	.....	.....	.....	.....	.....
	IC	10,000	10,000	.....	.....	.....	.....	.....
	Total	44,500	10,000	.....	.....	.....	.....	.....
Rayne, La.....	IC	4,370	.....	.....	3,000	.....	1,500	4,500
San Antonio, Texas.	Steam	502,200	100,000	100,000	.....	100,000	100,000	300,000
Stillwater, Okla....	Steam	18,000	.....	15,000	.....	.....	.....	15,000
Tonkawa, Okla.....	IC	2,540	.....	.....	.....	1,200	.....	1,200
Total.....	**Steam**	**887,550**	**178,650**	**159,000**	**116,500**	**122,000**	**281,000**	**678,500**
	IC	**66,500**	**10,000**	**4,860**	**5,500**	**1,200**	**4,000**	**15,560**
	Total	**954,050**	**188,650**	**163,860**	**122,000**	**123,200**	**285,000**	**694,060**
Cooperatives								
Brazos Electric Power	Hydro	55,000	.....	.....	.....	.....	.....	.....
	Steam	56,000	33,000	.....	.....	.....	.....	.....
	Total	111,000	33,000	.....	.....	.....	.....	.....
Central Rural Electric	Hydro	4,000	4,000	.....	1,500	4,000	.....	5,500
Medina Electric....	Steam	.....	.....	.....	66,000	.....	.....	66,000
Western Farmers Electric	Steam	30,000	.....	44,000	.....	.....	.....	44,000
	IC	4,400	.....	.....	.....	.....	.....	.....
	Total	34,400	.....	44,000	.....	.....	.....	44,000
Total.....	**Hydro**	**59,000**	**4,000**	.....	**1,500**	**4,000**	.....	**5,500**
	Steam	**86,000**	**33,000**	**44,000**	**66,000**	.....	.....	**110,000**
	IC	**4,400**	.....	.....	.....	.....	.....	.....
	Total	**149,400**	**37,000**	**44,000**	**67,500**	**4,000**	.....	**115,500**
Federal Agencies								
Corps of Engineers.	Hydro	501,000	.....	.....	200,000	90,000	647,000	937,000
Total.....	**Hydro**	**501,000**	.....	.....	**200,000**	**90,000**	**647,000**	**937,000**
West South Central Total All Agencies	**Hydro**	**635,630**	**4,000**	.....	**201,500**	**94,000**	**647,000**	**942,500**
	Steam	**11,630,334**	**1,877,500**	**1,794,750**	**1,665,500**	**1,407,500**	**2,513,100**	**7,380,850**
	IC	**170,330**	**15,000**	**4,860**	**6,500**	**1,200**	**4,000**	**16,560**
	Total	12,436,294	1,896,500	1,799,610	1,873,500	1,502,700	3,164,100	8,339,910

	Prime Mover	Capacity End 1958	1958	1959	1960	1961	After 1961	Total Additions Now Planned
Oklahoma G. & E.	Steam	782,496	178,600	240,000	.....	.....	178,600	418,600
	IC	13,099	.....	.....	.....	.....	.....	.....
	Total	795,595	178,600	240,000	.....	.....	178,600	418,600
Public Service of Oklahoma	Steam	787,338	210,500	.....	.....	170,000	190,000	360,000
	IC	6,000	.....	.....	.....	.....	.....	.....
	Total	793,338	210,500	.....	.....	170,000	190,000	360,000
Southwestern Electric Power	Steam	419,500	.....	114,000	114,000	.....	171,000	399,000
Southwestern Public Service	Hydro	330	.....	.....	.....	.....	.....	.....
	Steam	639,000	.....	.....	.....	112,500	112,500	225,000
	IC	11,230	.....	.....	.....	.....	.....	.....
	Total	650,560	.....	.....	.....	112,500	112,500	225,000
Texas Electric Service	Steam	967,200	115,000	175,000	240,000	.....	.....	415,000
	IC	12,396	.....	.....	.....	.....	.....	.....
	Total	979,596	115,000	175,000	240,000	.....	.....	415,000
Texas Power & Light	Steam	571,300	156,250	200,000	.....	.....	.....	200,000
	IC	16,520	.....	.....	.....	.....	.....	.....
	Total	587,820	156,250	200,000	.....	.....	.....	200,000
West Texas Utilities	Steam	209,500	.....	89,500	.....	80,000	.....	169,500
	IC	21,292	5,000	.....	1,000	.....	.....	1,000
	Total	230,792	5,000	89,500	1,000	80,000	.....	170,500
Total	**Hydro**	**75,630**	.....	.....	.....	.....	.....	.....
	Steam	**10,656,784**	**1,665,850**	**1,591,750**	**1,483,000**	**1,285,500**	**2,232,100**	**6,592,350**
	IC	**99,430**	**5,000**	.....	**1,000**	.....	.....	**1,000**
	Total	**10,831,844**	**1,670,850**	**1,591,750**	**1,484,000**	**1,285,500**	**2,232,100**	**6,593,350**
Municipal, State and Power District Systems								
Austin, Texas	Steam	154,000	44,000	.....	100,000	.....	100,000	200,000
Brady, Texas	IC	5,200	.....	2,500	.....	.....	.....	2,500
Bryan, Texas	Steam	21,500	.....	22,000	.....	.....	.....	22,000
	IC	4,790	.....	.....	.....	.....	.....	.....
	Total	26,290	.....	22,000	.....	.....	.....	22,000
Coleman, Texas	Steam	1,750	.....	.....	.....	.....	.....	.....
	IC	2,500	.....	1,000	.....	.....	2,500	3,500
	Total	4,250	.....	1,000	.....	.....	2,500	3,500
Denton, Texas	Steam	25,300	.....	.....	.....	22,000	22,000	44,000
	IC	12,350	.....	.....	.....	.....	.....	.....
	Total	37,650	.....	.....	.....	22,000	22,000	44,000
Greenville, Texas	Steam	.....	.....	.....	16,500	.....	.....	16,500
Jasper, Texas	IC	5,150	.....	1,360	2,500	.....	.....	3,860

Mountain

Power Companies	Prime Mover	Capacity End 1958	1958	1959	1960	1961	After 1961	Total Additions Now Planned
Arizona P S	Hydro	5,800	.....	.....	.....	.....	.....	.....
	Steam	367,600	.....	.....	220,000	.....	516,000	736,000
	IC	17,700	.....	.....	.....	.....	.....	.....
	Total	391,100	.....	.....	220,000	.....	516,000	736,000
Idaho Power	Hydro	617,590	337,500	112,500	218,000	.....	400,000	730,500
Montana Power	Hydro	530,000	60,000	.....	.....	.....	35,000	35,000
	Steam	66,000	.....	.....	.....	.....	.....	.....
	Total	596,000	60,000	.....	.....	.....	35,000	35,000
P S Co of Colorado	Hydro	37,900	.....	.....	.....	.....	.....	.....
	Steam	680,100	.....	115,000	48,000	.....	165,000	328,000
	IC	1,950	.....	.....	.....	.....	.....	.....
	Total	719,950	.....	115,000	48,000	.....	165,000	328,000
Public Service Co of New Mexico	Steam	208,000	49,000	.....	49,000	.....	70,000	119,000
Southern Colorado Power	Hydro	1,500	.....	.....	.....	.....	.....	.....
	Steam	57,468	.....	22,500	.....	.....	.....	22,500
	Total	58,968	.....	22,500	.....	.....	.....	22,500
Southern Nevada Power	Steam	104,000	.....	.....	.....	73,000	.....	73,000
Tucson Gas, El & P	Steam	175,500	75,000	.....	75,000	.....	.....	75,000
	IC	13,000	.....	.....	.....	.....	.....	.....
	Total	188,500	75,000	.....	75,000	.....	.....	75,000
Utah P & L	Hydro	168,210	.....	.....	.....	.....	.....	.....
	Steam	510,750	.....	.....	.....	.....	500,000	500,000
	IC	3,470	.....	.....	.....	.....	.....	.....
	Total	682,430	.....	.....	.....	.....	500,000	500,000
Western Colorado Power	Hydro	13,232	.....	.....	.....	.....	.....	.....
	Steam	18,000	.....	.....	.....	.....	12,650	12,650
	Total	31,232	.....	.....	.....	.....	12,650	12,650
Total	**Hydro**	**1,374,232**	**397,500**	**112,500**	**218,000**	.....	**435,000**	**765,500**
	Steam	**2,187,418**	**124,000**	**137,500**	**392,000**	**73,000**	**1,263,650**	**1,866,150**
	IC	**36,120**	.....	.....	.....	.....	.....	.....
	Total	**3,597,770**	**521,500**	**250,000**	**610,000**	**73,000**	**1,698,650**	**2,631,650**
Municipal, State and Power District Systems								
Colorado Springs, Colo.	Hydro	6,000	.....	.....	.....	.....	.....	.....
	Steam	80,000	.....	.....	.....	.....	33,000	33,000
	Total	86,000	.....	.....	.....	.....	33,000	33,000

	Prime Mover	Capacity End 1958	1958	1959	1960	1961	After 1961	Total Additions Now Planned
Farmington, N. M.	Steam	16,735	9,375					
La Junta, Colo.	IC	7,128	3,000					
Lamar, Colo.	Steam	9,500						
	IC	2,000					12,500	12,500
	Total	11,500					12,500	12,500
Raton, N. M.	Steam	6,000					7,500	7,500
Salt River Project	Hydro	70,890						
	Steam	347,272	113,636			168,000		168,000
	IC	10,000						
	Total	428,162	113,636			168,000		168,000
Walsenburg, Colo.	Steam	12,500	6,250					
Total	**Hydro**	**76,890**						
	Steam	**472,007**	**129,261**			**168,000**	**40,500**	**208,500**
	IC	**19,128**	**3,000**				**12,500**	**12,500**
	Total	**568,025**	**132,261**			**168,000**	**53,000**	**221,000**
Cooperatives								
Colorado-Ute Electric	Steam	37,950		37,950				37,950
Empire Electric Ass'n, Inc.	IC	850	850					
Garkane Power Ass'n	Hydro	2,775	2,775					
	IC	210	210					
	Total	2,985	2,985					
Lower Valley P & L	Hydro	3,080					5,000	5,000
	IC	1,560						
	Total	4,640					5,000	5,000
Plains Electric G. & T.	Steam	33,000		16,500			33,000	49,500
Total	**Hydro**	**5,855**	**2,775**				**5,000**	**5,000**
	Steam	**70,950**		**54,450**			**33,000**	**87,450**
	IC	**2,620**	**1,060**					
	Total	**79,425**	**3,835**	**54,450**			**38,000**	**92,450**
Federal Agencies								
Bureau of Reclamation	Hydro	2,471,225	60,375	4,500	56,400	204,600	1,672,100	1,937,600
Corps of Engineers	Hydro	85,000				80,000		80,000
Total	**Hydro**	**2,556,225**	**60,375**	**4,500**	**56,400**	**284,600**	**1,672,100**	**2,017,600**
Mountain	**Hydro**	**4,013,202**	**460,650**	**117,000**	**274,400**	**284,600**	**2,112,100**	**2,788,100**
Total All Agencies	**Steam**	**2,730,375**	**253,261**	**191,950**	**392,000**	**241,000**	**1,337,150**	**2,162,100**
	IC	**57,868**	**4,060**				**12,500**	**12,500**
	Total	**6,801,445**	**717,971**	**308,950**	**666,400**	**525,600**	**3,461,750**	**4,962,700**

	Prime Mover	Capacity End 1958	1958	1959	1960	1961	After 1961	Total Additions Now Planned
Hetch Hetchy Water Supply & Power Project	Hydro	73,600			135,000		67,500	202,500
Los Angeles, Cal.	Hydro	737,000						
	Steam	943,000		312,000			400,000	712,000
	Total	1,680,000		312,000			400,000	712,000
Merced Irrigation District	Hydro	31,250					62,750	62,750
Pasadena, Cal.	Hydro	11,000					60,000	60,000
	Steam	155,000						
	Total	166,000					60,000	60,000
P.U.D. No. 1 Chelan County, Wash	Hydro	260,100			202,800	405,600	101,400	709,800
P.U.D. No. 2 of Grant County	Hydro			160,000	640,000		640,000	1,440,000
Sacramento, Cal.	Hydro				66,500		174,500	241,000
San Francisco, Cal.	Hydro	73,600			135,000		67,500	202,500
Seattle, Wash.	Hydro	641,656	25,000		57,000		600,000	657,000
	Steam	51,000						
	Total	692,656	25,000		57,000		600,000	657,000
Tacoma, Wash.	Hydro	238,000				120,000	340,000	460,000
	Steam	59,000						
	Total	297,000				120,000	340,000	460,000
Turlock Irrigation Dist.	Hydro	25,000					65,000	65,000
Total	**Hydro**	**2,114,006**	**25,000**	**160,000**	**1,236,300**	**525,600**	**2,234,650**	**4,156,550**
	Steam	**1,363,000**		**400,000**			**488,000**	**888,000**
	Total	**3,477,006**	**25,000**	**560,000**	**1,236,300**	**525,600**	**2,722,650**	**5,044,550**
Federal Agencies								
Bonneville Power Administration	Hydro	2,252,250	11,250					
Bureau of Reclamation	Hydro	2,626,750	11,250	16,000			369,850	385,850
Corps of Engineers	Hydro	3,270,400	568,000	312,000	312,000	325,000	3,568,000	4,517,000
Total	**Hydro**	**8,149,400**	**590,500**	**328,000**	**312,000**	**325,000**	**3,937,850**	**4,902,850**
Pacific	**Hydro**	**14,653,746**	**1,423,158**	**782,000**	**1,938,300**	**1,367,100**	**6,172,800**	**10,260,200**
Total All Agencies	**Steam**	**8,055,050**	**923,500**	**920,000**	**579,500**	**829,500**	**612,500**	**2,941,500**
	IC	**35,200**						
	Total	22,743,996	2,346,658	1,702,000	2,517,800	2,196,600	6,785,300	13,201,700

Pacific

Total United States

Pacific

Power Companies	Prime Mover	Capacity End 1958	1958	1959	1960	1961	After 1961	Total Additions Now Planned
California Electric Power	Hydro	47,570	.....	.....	.....	.....	.....	.....
	Steam	260,000	62,500	80,000	.....	64,500	64,500	209,000
	Total	307,570	62,500	80,000	.....	64,500	64,500	209,000
California Oregon Power	Hydro	398,750	88,000	.....	.....	516,500	.....	516,500
	IC	200	.....	.....	.....	.....	.....	.....
	Total	398,950	88,000	.....	.....	516,500	.....	516,500
Pacific G & E.....	Hydro	1,922,500	470,500	.....	.....	.....	.....	.....
	Steam	3,296,500	215,000	.....	337,500	325,000	60,000	722,500
	IC	5,000	.....	.....	.....	.....	.....	.....
	Total	5,224,000	685,500	.....	337,500	325,000	60,000	722,500
Pacific Power & Light	Hydro	249,000	249,000	.....	.....	.....	.....	.....
	Steam	100,000	100,000	.....	100,000	.....	.....	100,000
	Total	349,000	349,000	.....	100,000	.....	.....	100,000
Portland General Electric	Hydro	287,300	158	.....	.....	.....	300	300
	Steam	88,000	.....	.....	.....	.....	.....	.....
	Total	375,300	158	.....	.....	.....	300	300
Puget Sound P & L	Hydro	177,350	.....	94,000	64,000	.....	.....	158,000
	Steam	87,500	.....	.....	.....	.....	.....	.....
	Total	264,850	.....	94,000	64,000	.....	.....	158,000
San Diego G & E.	Steam	587,000	106,000	.....	142,000	.....	.....	142,000
Southern California Edison	Hydro	953,220	.....	.....	126,000	.....	.....	126,000
	Steam	2,273,050	440,000	440,000	.....	440,000	.....	880,000
	IC	30,000	.....	.....	.....	.....	.....	.....
	Total	3,256,270	440,000	440,000	126,000	440,000	.....	1,006,000
Washington Water Power	Hydro	354,650	.....	200,000	200,000	.....	.....	400,000
Total.....	**Hydro**	**4,390,340**	**807,658**	**294,000**	**390,000**	**516,500**	**300**	**1,200,800**
	Steam	**6,692,050**	**923,500**	**520,000**	**579,500**	**829,500**	**124,500**	**2,053,500**
	IC	**35,200**	.....	.....	.....	.....	.....	.....
	Total	**11,117,590**	**1,731,158**	**814,000**	**969,500**	**1,346,000**	**124,800**	**3,254,300**
Municipal, State and Power District Systems								
Burbank, Cal.....	Steam	70,000	.....	44,000	.....	.....	44,000	88,000
Eugene, Ore.....	Hydro	22,800	.....	.....	.....	.....	56,000	56,000
	Steam	25,000	.....	.....	.....	.....	.....	.....
	Total	47,800	.....	.....	.....	.....	56,000	56,000
Glendale, Cal....	Steam	60,000	.....	44,000	.....	.....	44,000	88,000

Total United States

Prime Mover	Capacity End 1958	1958	1959	1960	1961	After 1961	Total Additions Now Planned
Hydro.....	**29,526,819**	**2,430,653**	**1,378,400**	**2,876,300**	**3,555,700**	**11,482,200**	**19,292,600**
Steam.....	**107,209,101**	**12,817,021**	**12,831,805**	**9,668,355**	**7,255,000**	**11,681,750**	**41,436,910**
IC.....	**932,885**	**35,868**	**54,720**	**14,500**	**23,300**	**73,250**	**165,770**
Total.....	**137,668,805**	**15,283,542**	**14,264,925**	**12,559,155**	**10,834,000**	**23,237,200**	**60,895,280**

U. S. Possessions

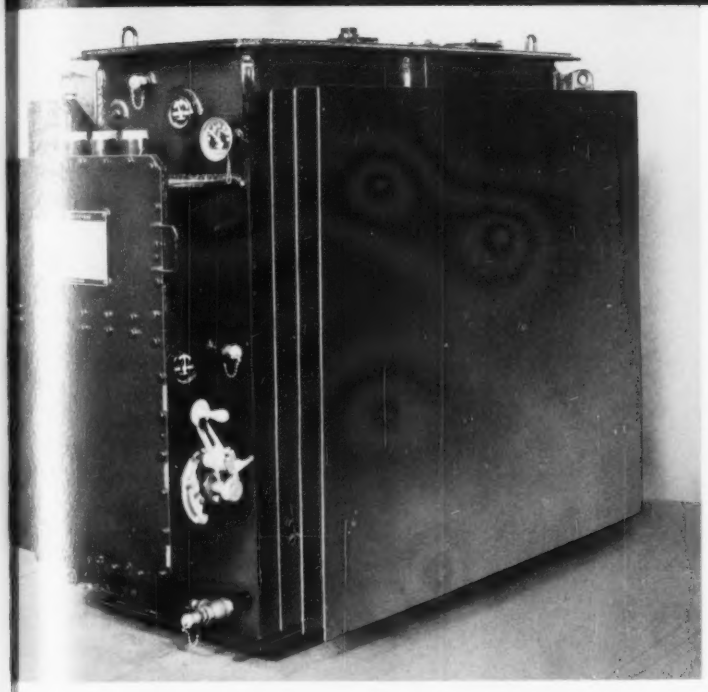
	Prime Mover	Capacity End 1958	1958	1959	1960	1961	After 1961	Total Additions Now Planned
Alaska Electric Light & Power	Hydro	1,600	.....	.....	.....	.....	.....	.....
	IC	2,500	.....	.....	2,500	.....	.....	2,500
	Total	4,100	.....	.....	2,500	.....	.....	2,500
Golden Valley Electric Ass'n.	Steam	9,500	.....	.....	.....	16,500	33,000	49,500
Hawaiian Electric	Steam	287,000	.....	60,000	.....	.....	60,000	120,000
Hilo Electric Light.....	Hydro	3,400	.....	.....	.....	.....	.....	.....
	Steam	24,500	7,500	.....	15,000	.....	.....	15,000
	IC	7,750	.....	.....	.....	.....	.....	.....
	Total	35,650	7,500	.....	15,000	.....	.....	15,000
Ketchikan Public Utilities	Hydro	11,200	.....	.....	4,000	.....	.....	4,000
	IC	942	.....	.....	.....	.....	.....	.....
	Total	12,142	.....	.....	4,000	.....	.....	4,000
Kodiak Electric Ass'n..	IC	3,218	1,600	.....	.....	.....	.....	.....
Puerto Rico Water Resources Authority	Hydro	109,220	.....	.....	.....	.....	.....	.....
	Steam	244,500	44,000	44,000	82,500	82,500	350,000	559,000
	IC	.....	.....	20,000	20,000	.....	.....	40,000
	Total	353,720	44,000	64,000	102,500	82,500	350,000	599,000
Sitka Public Utilities	Hydro	.....	.....	.....	6,000	.....	.....	6,000
	IC	1,250	500	500	.....	.....	.....	500
	Total	1,250	500	500	6,000	.....	.....	6,500
Virgin Islands Corp...	IC	7,230	570	965	2,500	2,500	.....	5,965
Total.....	**Hydro**	**125,420**	.....	.....	**10,000**	.....	.....	**10,000**
	Steam	**565,500**	**51,500**	**104,000**	**97,500**	**99,000**	**443,000**	**743,500**
	IC	**22,890**	**2,670**	**21,465**	**25,000**	**2,500**	.....	**48,965**
	Total	**713,810**	**54,170**	**125,465**	**132,500**	**101,500**	**443,000**	**802,465**

Canada

	Prime Mover	Capacity End 1958	1958	1959	1960	1961	After 1961	Total Additions Now Planned
Aluminum Company of Canada	Hydro	2,372,500	112,500	660,000	165,000	.....	112,500	937,500
British Columbia Electric	Hydro	862,780	.....	130,500	150,500	.....	.....	281,000
	Steam	.....	.....	.....	.....	360,000	360,000	720,000
	IC	2,205	.....	120,810	.....	.....	.....	120,810
	Total	864,985	.....	251,310	150,500	360,000	360,000	1,121,810
British Columbia Power Commission	Hydro	326,500	37,500	28,000	.....	.....	42,000	70,000
	IC	145,800	51,200	37,720	7,200	18,000	.....	62,920
	Total	472,300	88,700	65,720	7,200	18,000	42,000	132,920
Calgary Power....	Hydro	240,000	.....	.....	80,000	.....	.....	80,000
	Steam	144,000	72,000	.....	.....	.....	150,000	150,000
	Total	384,000	72,000	.....	80,000	.....	150,000	230,000
Canadian Utilities..	Steam	75,000	.....	.....	.....	.....	40,000	40,000
	IC	33,000	12,800	.....	.....	.....	.....	.....
	Total	108,000	12,800	.....	.....	.....	40,000	40,000
Churchill River Power	Hydro	90,000	.....	18,000	.....	.....	.....	18,000
Great Lakes Power	Hydro	161,772	22,222	22,222	.....	.....	.....	22,222
Hydro-Electric Power Commission of Ontario	Hydro	4,820,321	975,600	636,500	22,500	112,500	45,000	816,500
	Steam	700,116	.....	470,000	470,000	487,600	353,000	1,780,600
	IC	2,281	.....	.....	.....	.....	.....	.....
	Total	5,522,718	975,600	1,106,500	492,500	600,100	398,000	2,597,100
Lethbridge, Alberta	Steam	14,860	.....	.....	.....	.....	.....	.....
	IC	8,000	.....	.....	.....	8,000	.....	8,000
	Total	22,860	.....	.....	.....	8,000	.....	8,000
Lower St. Lawrence Power	Hydro	13,000	.....	.....	.....	.....	.....	.....
	IC	5,000	.....	2,500	.....	.....	.....	2,500
	Total	18,000	.....	2,500	.....	.....	.....	2,500
Manitoba Hydro-Electric Board	Hydro	482,000	.....	.....	75,000	75,000	37,500	187,500
	Steam	99,000	99,000	66,000	66,000	.....	.....	132,000
	Total	581,000	99,000	66,000	141,000	75,000	37,500	319,500
Manitoba Power Commission	IC	3,150	3,150	.....	.....	.....	.....	.....
Maritime Electric Co.	Steam	24,800	.....	.....	.....	15,000	.....	15,000
New Brunswick Electric Power Commission	Hydro	116,000	40,000	.....	.....	.....	.....	.....
	Steam	119,000	.....	.....	.....	50,000	.....	50,000
	IC	1,360	.....	.....	.....	.....	.....	.....
	Total	236,360	40,000	.....	.....	50,000	.....	50,000
Newfoundland Light & Power	Hydro	58,000	15,000	.....	.....	7,500	.....	7,500
	Steam	11,800	.....	23,000	.....	.....	.....	23,000
	IC	2,500	.....	.....	.....	.....	.....	.....
	Total	72,300	15,000	23,000	.....	7,500	.....	30,500
Northern British Columbia Power Commission	Hydro	8,000	.....	.....	.....	.....	6,000	6,000
	Steam	1,000	.....	.....	.....	.....	.....	.....
	IC	5,700	.....	2,540	.....	.....	.....	2,540
	Total	14,700	.....	2,540	.....	.....	6,000	8,540
Northern Canada Power Commission	Hydro	26,400	13,400	.....	7,500	.....	.....	7,500
	Steam	750	750	.....	.....	1,000	.....	1,000
	IC	2,845	1,125	125	750	1,000	.....	1,875
	Total	29,995	15,275	125	8,250	2,000	.....	10,375
Nova Scotia Light & Power	Hydro	51,651	7,500	.....	5,000	.....	10,000	15,000
	Steam	149,558	.....	53,000	.....	.....	100,000	153,000
	IC	2,400	.....	.....	.....	.....	.....	.....
	Total	203,609	7,500	53,000	5,000	.....	110,000	168,000
Nova Scotia Power Commission	Hydro	95,725	.....	17,500	.....	44,500	37,500	99,500
	Steam	50,000	.....	25,000	.....	.....	.....	25,000
	IC	1,847	.....	.....	.....	.....	.....	.....
	Total	147,572	.....	42,500	.....	44,500	37,500	124,500
Quebec Hydro-Electric Commission	Hydro	2,552,000	360,000	620,000	500,000	130,000	.....	1,250,000
Regina, Saskatchewan	Steam	85,000	.....	.....	.....	.....	.....	.....
	IC	.....	.....	28,000	.....	.....	.....	28,000
	Total	85,000	.....	28,000	.....	.....	.....	28,000
Saskatchewan Power	Hydro	.....	.....	.....	.....	.....	200,000	200,000
	Steam	312,000	75,000	237,000	.....	.....	.....	237,000
	IC	56,000	20,000	.....	.....	.....	.....	.....
	Total	368,000	95,000	237,000	.....	.....	200,000	437,000
Shawinigan Water & Power	Hydro	1,806,250	270,000	.....	.....	.....	.....	.....
Spruce Falls Power & Paper	Hydro	58,750	.....	.....	.....	.....	.....	.....
	Steam	27,550	10,700	.....	.....	.....	.....	.....
	Total	86,300	10,700	.....	.....	.....	.....	.....
Strathroy, Ontario.	Hydro	5,400	400	650	350	350	500	1,850
Total	**Hydro**	**14,147,049**	**1,854,122**	**2,133,372**	**1,005,850**	**369,850**	**491,000**	**4,000,072**
	Steam	**1,814,434**	**257,450**	**874,000**	**536,000**	**913,600**	**1,003,000**	**3,326,600**
	IC	**272,088**	**88,275**	**191,695**	**7,950**	**27,000**	.....	**226,645**
	Total	**16,233,571**	**2,199,847**	**3,199,067**	**1,549,800**	**1,310,450**	**1,494,000**	**7,553,317**

DISTRIBUTION

Equipment News



In this issue . . .

- **NEW WELDED LOW-VOLTAGE BUSHINGS** provide hermetic seal on Vaultmaster network transformers

- **NEW SEMI-BURIED TRANSFORMER ENCLOSURES** permit safe, economical use of standard, pole-type units in underground systems

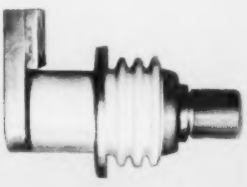
GENERAL ELECTRIC

NEW, ALUMINA BUSHINGS welded to the tank inside the L-V throat of a G-E network transformer are shown by design engineer Jerry O'Connell. Transformer is equipped with panel radiators and suspension hooks.

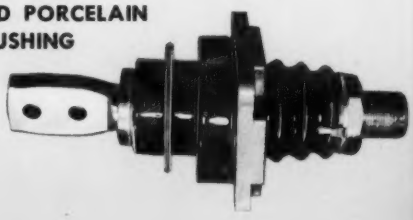
COMPARISON OF NEW ALUMINA AND OLD BUSHINGS

	PORCELAIN	GLASS	ALUMINA
PHYSICAL STRENGTH			
Tensile	3000–8000 psi	4000 psi	26500 psi
Compressive	25000–50000 psi	90000–120000 psi	285000 psi
Flexural	9000–15000 psi	15000–36000 psi	43500 psi
DIELECTRIC STRENGTH	220 VOLTS/MIL	240 VOLTS/MIL	250 VOLTS/MIL
LENGTH			
1½" Stud	13 inches	12 $\frac{13}{16}$ inches	7 $\frac{1}{8}$ inches
2" Stud	14 $\frac{3}{8}$" inches	17 $\frac{5}{16}$ inches	9 $\frac{3}{32}$ inches

NEW
WELDED ALUMINA BUSHING



OLD
CLAMPED PORCELAIN BUSHING



New Welded Bushings on G-E Network Transformers

Hermetically sealed L-V alumina bushings cut maintenance costs, simplify installation

COMPLETELY NEW LOW-VOLTAGE BUSHINGS for network transformers—made of alumina instead of porcelain or glass—are now used on G-E Vaultmaster transformers. The new bushings offer big savings in maintenance costs because of improved sealing. They also simplify installation by reducing over-all height.

REDUCED MAINTENANCE COSTS

New alumina bushings practically eliminate maintenance troubles caused by leaky L-V bushings. The bushings are welded to the tank, instead of clamped, bringing the new G-E units a step closer to the ideal of a hermetically sealed network transformer.

SIMPLIFIED INSTALLATION

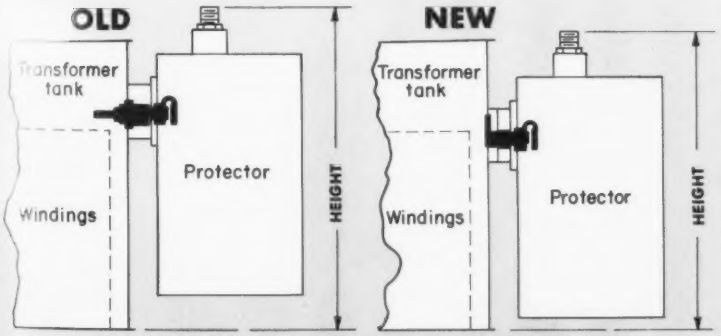
New alumina bushings simplify installation by allowing more room to make cabling connections. Since alumina bushings are shorter than the old types, they are contained entirely within the transformer throat. The throat can thus be lowered, reducing the height of the transformer-protector combination.

SIMPLE CONSTRUCTION

A metal coating is fired on the alumina shell, permitting a special alloy steel cap and a mounting ring to be brazed directly to the alumina. In assembling the bushing, the cap is welded to the conductor stud. The bushing is mounted by welding the mounting ring to an insert in the tank wall. Inert arc welding is used for all sealing.

Progress Is Our Most Important Product

GENERAL ELECTRIC



HEIGHT OF PROTECTOR STUD ABOVE FLOOR			
KVA	OLD	KVA	NEW
500	57 inches	500	54 inches
750	70 inches	750	66 inches
1000	75 inches	1000	70 inches

Welded Bushings Bring Vaultmaster One Step Closer to the Ideal Transformer

HAROLD BRUNTON, JR.

Manager—Network Transformer Sales

For many years, there has been a slow but steady trend toward hermetically sealed network transformers. The trend is understandable in view of the fact that a completely sealed unit is less susceptible to leakage troubles and has less chance of inhaling moisture or other contaminants.

The first big steps were taken around 1940. We welded on the tank cover and switch box and devised a way of eliminating gaskets around the thermometer.

The high-voltage end was the next area to be sealed. Wipe entrances were welded to the terminal chamber. It also became possible to weld on the covers for the high-voltage terminal chamber and switch compartment.

When the welded-on magnetic liquid level gage was perfected, just two openings remained into the network transformer. They were the gasketed low-voltage bushings and the high-voltage switch handle (which is effectively sealed with a packing gland).

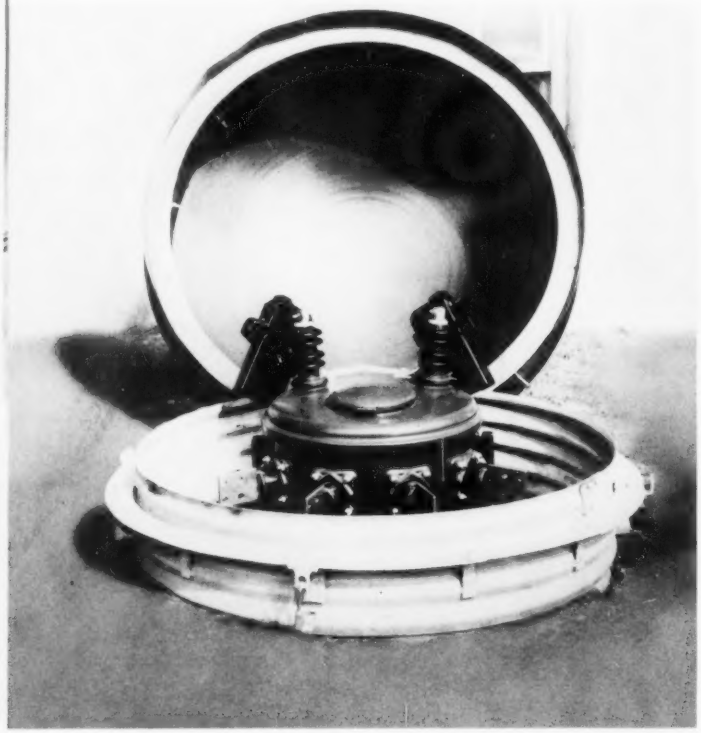
In 1945 we had started supplying solder-seal glass bushings on a limited basis. Since then, glass bushing use had been improved with a change to brazing and just recently, a change to a welded construction. However, we have always wanted a mechanically stronger material than glass. Alumina bushings proved to be the answer.

Alumina is a very hard, shock-resistant ceramic, composed primarily of aluminum oxide (Al_2O_3). It was introduced several years ago on our hermetically sealed pulse and radar transformers. As shown by the comparison table at left, alumina characteristics are superior and our experience with them has been excellent.

Welded alumina bushings are also shorter than previous types. We could use this reduction in one of two ways—shorten the over-all transformer length or reduce the height over the network protector stud. After careful deliberation, we chose the latter because we felt the height was a more critical dimension. Also, we wanted to maintain the working clearance established by EEI-NEMA between transformer tank and protector.

The use of welded alumina bushings brings our standard Vaultmaster units a step closer to the ideal of a hermetically sealed transformer. We anticipate the day when "welded" low-voltage bushings will become standard industry construction.

New G-E Semi-buried Transformer Enclosure Permits Safe, Economical Underground Distribution



NEW G-E ENCLOSURE allows plenty of room for transformer installation and connection. Unit above contains a General Electric 167-kva transformer plus two General Electric cutouts with disconnect blades.

The new G-E semi-buried distribution transforme enclosure provides a safe and economical method o supplying power to modern pole-free residentia developments.

The new enclosure easily accommodates pole-typ transformers through 167 kva, with plenty of roon left for adding disconnects. Thus, linemen experi enced in overhead system practices can easily mak connections. G-E semi-buried installation can als be easily uprated by merely replacing the trans former.

The 54-inch diameter enclosure is designed fo mounting on 48-inch corrugated culvert pipe. Th hinged cover projects only 33 inches above ground.

Vent openings are completely baffled for safety o children and for the protection of the transformer against small animals. The all-steel enclosure easily withstands the rigors of field installation.

ADDITIONAL INFORMATION

For additional information on General Electric semi-buried transformer enclosures, contact your nearest General Electric Apparatus Sales Office, or write to General Electric Co., Section 431-84, Schenectady 5, N. Y., for bulletin GEA-6857, "New Semi-buried Transformer Enclosure."

Progress Is Our Most Important Product

GENERAL ELECTRIC

Mobile Transformer to Serve 18 PG&E Subs

This mobile, combination autotransformer and single-phase transformer was built by General Electric to serve 18 substations on Pacific Gas & Electric's system. It reportedly is the highest-rated and largest in size of any such unit. As an autotransformer, it is rated 40,000 kva, 230/138/120/69 kv. As a single-phase transformer, it has windings rated 22,222 kva at 13.2 kv with taps for 8,860 and 4,430 v.

With the transformer installed, the unit is 60 ft long, 13½ ft high. The 32-wheel, 42-ft trailer, designed by Bigge Drayage Co, San Leandro, and made by F.A.B. Mfg Co, Oakland, will be the permanent mounting for the unit. The transformer was designed as a standby unit in case of failure in a permanently installed transformer.

The transformer and special trailer are valued at approximately $200,000.

The unit will be based at Monte Vista Substation, for use at substations from Redding to Bakersfield.

Pallet Shipping Cuts Transformer Handling Costs

A crateless shipping method for distribution transformers, successfully tested for one year by Westinghouse Electric and now made available, reduces customers' handling and storage costs up to $2.00 per transformer. Transformers are fastened to flat wooden pallets by two metal straps banded over their lifting lugs.

The damages incurred during the one-year test were found to be even less by this shipping method than when wooden crates are used. The pallet package can be conveyed faster and easier than a crate, with little bulk wood disposal. Shipments take less space, since they can be warehoused several tiers deep either inside or outside. Stenciling of company identification can be accomplished without removing the transformer from the pallet.

By cutting straps with wire snips or by removing banding pins with pliers, a crateless transformer can quickly be removed from its pallet.

Pallet-mounted transformers can be shipped by truck or rail, single or multiple deck.

(*More Manufacturers News on page* 122)

APPALACHIA
VIKI

THE MAN WHO HAS TO KNOW,
R. H. PORTER, SUBSTATION FOREMAN
TELLS WHY . . .

DEPENDABILITY pays dividends for Appalachian Power's investment in General Electric Voltage Regulators

"We anticipate over 25 years' dependable service from our new G-E ML-32 step regulators installed in the last few months. The first modern step voltage regulator* ever built has been operating in our Roanoke District since 1932. It didn't need major maintenance until 1956."

Dependability means most reliable operation with least-possible maintenance. This is one reason why more G-E regulators are in use today than any other make. G-E tap changer samples are continuously being life-tested to assure you of over 25 years' normal service. This long-term extra value is yours through investment in G-E regulators.

G-E REGULATORS COST LESS ON THE LINE because you get continuing extra dividends . . . from **G-E DEPENDABILITY**—absolute minimum maintenance; in **G-E SERVICE**—routine or emergency; from **G-E RESEARCH**—superior regulating equipment. Result: Extra Values = **EXTRA PROFIT.**

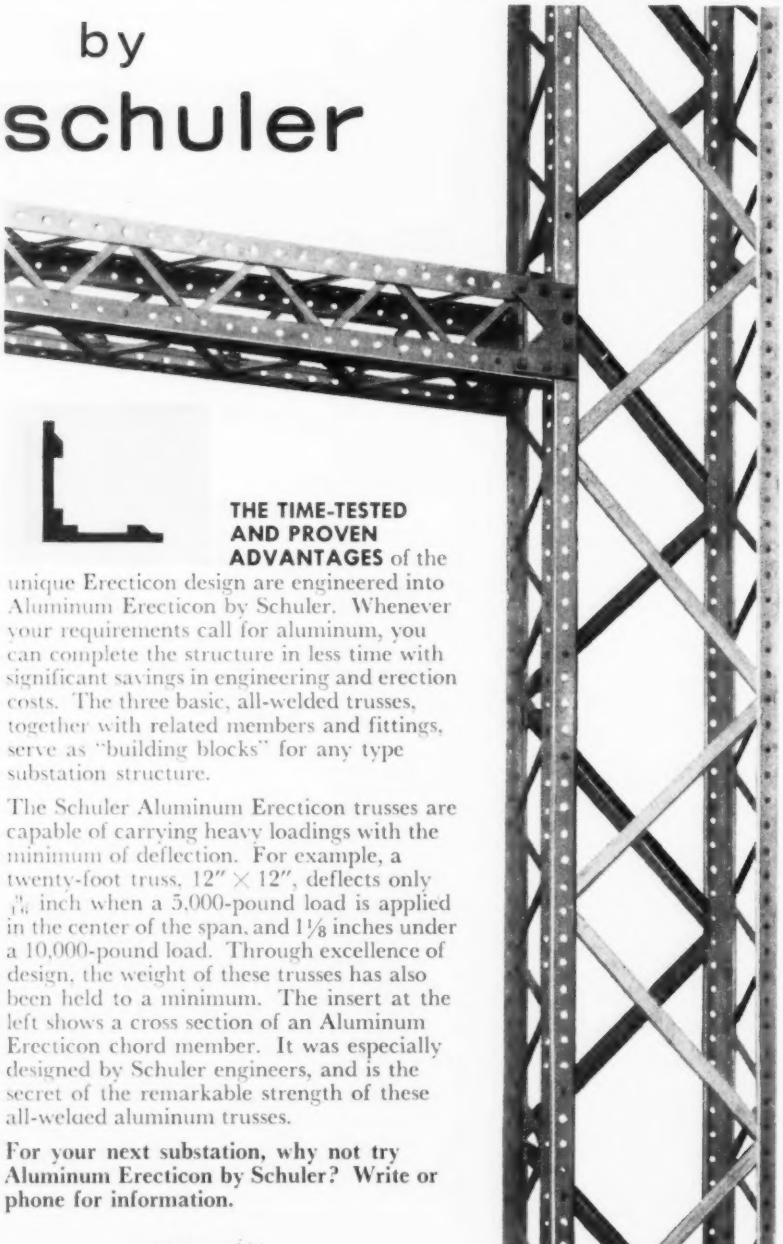
Only General Electric returns so much for your regulator investment. Ask your General Electric regulator representative to show you how. General Electric Co., Schenectady 5, New York. 423-35

** A G-E automatic step-type voltage regulator installed in the fall of 1932 on the Roanoke-Fincastle rural distribution line of the Appalachian Power Company near Roanoke, Va.*

Progress Is Our Most Important Product

GENERAL ELECTRIC

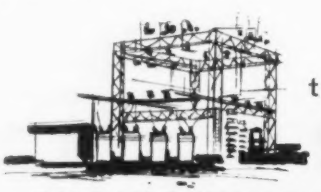
this is
ALUMINUM
ERECTICON
by
schuler



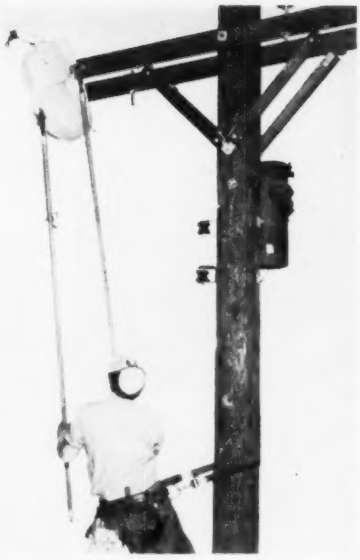
THE TIME-TESTED AND PROVEN ADVANTAGES of the unique Erecticon design are engineered into Aluminum Erecticon by Schuler. Whenever your requirements call for aluminum, you can complete the structure in less time with significant savings in engineering and erection costs. The three basic, all-welded trusses, together with related members and fittings, serve as "building blocks" for any type substation structure.

The Schuler Aluminum Erecticon trusses are capable of carrying heavy loadings with the minimum of deflection. For example, a twenty-foot truss, 12″ × 12″, deflects only $\frac{7}{16}$ inch when a 5,000-pound load is applied in the center of the span, and $1\frac{1}{8}$ inches under a 10,000-pound load. Through excellence of design, the weight of these trusses has also been held to a minimum. The insert at the left shows a cross section of an Aluminum Erecticon chord member. It was especially designed by Schuler engineers, and is the secret of the remarkable strength of these all-welded aluminum trusses.

For your next substation, why not try Aluminum Erecticon by Schuler? Write or phone for information.



the charles e.
schuler
ENGINEERING COMPANY
113 Cambria Street, Newark, Ohio



Plastic Cover for Cutouts Protects Utility Linemen

A plastic cover for cutouts has been developed to protect utility linemen. The cover was designed and is now being produced by Starline Co, Dayton, Ohio. The universal-type cover can be used with a wide variety of open-type, single-insulator, fused cutouts in the 5, 7.5 and 15-kv classes.

The cover design combines air space with a high dielectric plastic. It is said to withstand both weather extremes and the beating usually given line equipment.

The 3-lb cover, designated CCS-15, can be slipped on and off the cutout with little effort, either manually or with several types of hotsticks. After the cover is positioned, a locking pin is inserted to prevent removal.

Reynolds Has Light-Weight Cable-Reel Packing

Cable-reel packing for reel sizes 48A through 69B have been introduced by Reynolds Metals Co's Listerhill, Ala., plant which permits faster packing, affords equal protection, and is lighter in weight. Conventional wooden lags weigh up to 90% as much as the reel itself. The packing has a resilient padding of a fibrous material with adherent backing of moisture-resistant kraft paper, with an overwrap of plywood inside the reel

(*Continued on page* 125)

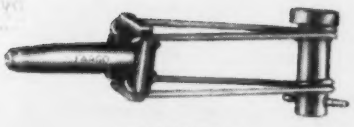
fast-easy-sure!

FARGO

DEAD ENDS

Automatic dead ends that are *automatic*. Fargo dead ends work right every time, and are designed for fast, easy and sure installations . . . a wide choice of flexible or solid bails and strap types to fit every job, *all* with Fargo's gripping units, are available.

new types . . .



"2 BDE" Series

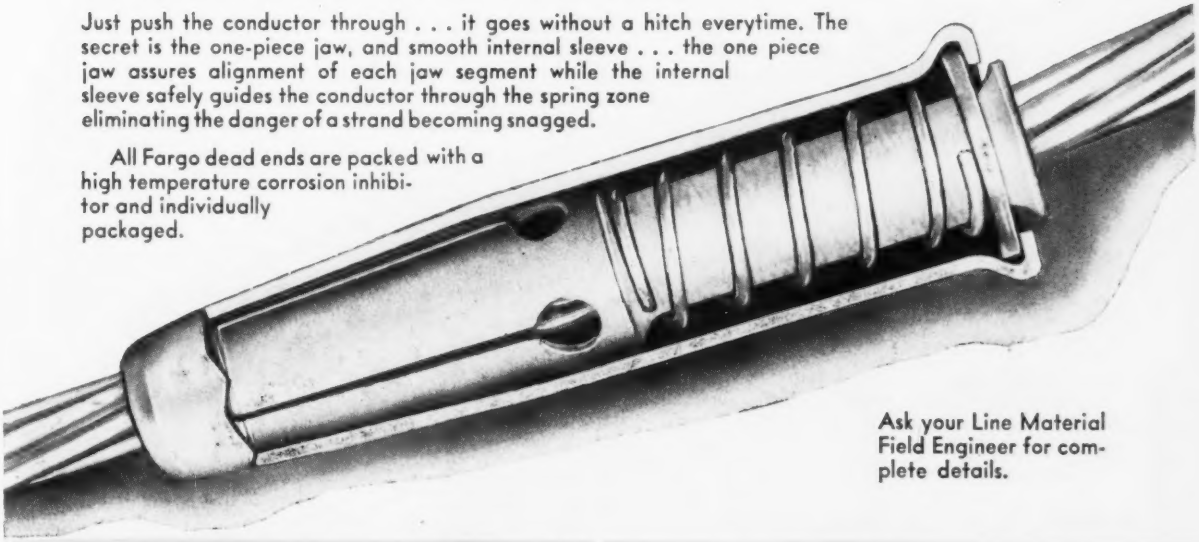
"D" Series

There are Fargo Dead Ends for copper or aluminum.

NO SNAGGING WITH FARGO

Just push the conductor through . . . it goes without a hitch everytime. The secret is the one-piece jaw, and smooth internal sleeve . . . the one piece jaw assures alignment of each jaw segment while the internal sleeve safely guides the conductor through the spring zone eliminating the danger of a strand becoming snagged.

All Fargo dead ends are packed with a high temperature corrosion inhibitor and individually packaged.

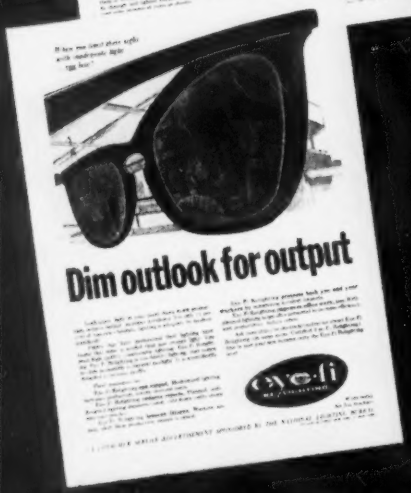


Ask your Line Material Field Engineer for complete details.

Distributed by
LINE MATERIAL INDUSTRIES
McGraw-Edison Company
Milwaukee, Wisconsin
In Canada, CANADIAN LINE MATERIALS, LTD., Toronto, Canada

Manufactured by
FARGO MFG. COMPANY, INC.
Poughkeepsie
New York

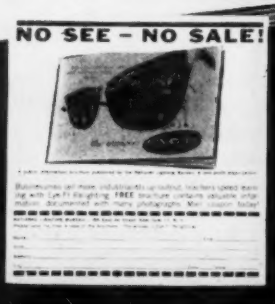
FARGO



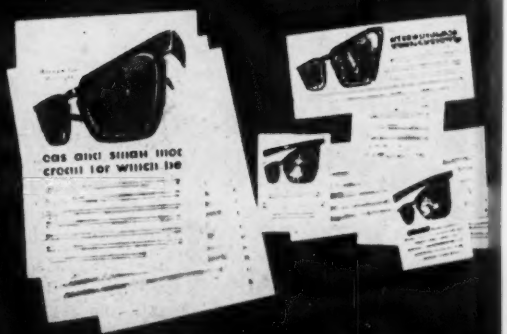
CONSUMER ADS to pinpoint the need for Eye-Fi Relighting in the trade publications of each major market.

When you limit their sight
with inadequate light
...you lose!
Modern methods of buying and selling, teaching and learning, manufacturing, and office management have steadily increased our need for light. Yet 85 per cent of America's commercial and industrial lighting is inadequate . . . creating a barrier between people and the things they do.
Those who have modernized their lighting have found that you need more than just enough light! You need high quality, comfortable lighting—Eye-Fi Relighting. Eye-Fi Relighting is eye fidelity lighting that comes as close as possible to natural daylight and gives you the benefits of today's lighting know-how.
Businessmen, industrialists and educators say:
Eye-Fi Relighting sells more. People like to look before they buy. Eye-Fi Relighting stops passersby, guides them into the store, and steers them straight to merchandise on display.
Eye-Fi Relighting ups output. Plants and offices report sizeable gains in production per man-hour, fewer on-the job accidents.
Eye-Fi Relighting speeds learning. When [illegible] can't read, it's often the light that's to blame.
Eye-Fi Relighting aids office work. Business[illegible] use it to increase efficiency, cut overtime costs, [illegible] morale, boost profits.
Ask your utility or electrical contractor about Eye-Fi Relighting (in some areas, Certified Eye-Fi Relighting). And be sure your new fixtures carry the Eye-Fi Relighting label.
eye-fi
RE/LIGHTING
A CONSUMER SERVICE ADVERTISEMENT SPONSORED BY THE NATIONAL LIGHTING

NATIONAL ADS in large-circulation, high-influence magazines, to launch the Eye-Fi program with power and prestige.



COUPON ADS to produce inquiries and leads, offering hard-selling and informative brochure through economical small space.



PROMOTIONAL AIDS designed for use by local groups, including self-mailers, ad-mats, envelope stuffers, etc.

PLUS publicity, prepared talks and slides, training programs, inter-industry information, sales aids and other materials to round out and complete the Eye-Fi Relighting promotion program.

PROFIT PREVIEW

COMING — *the dynamic new Eye-Fi Relighting program — with profits for all!*

WHAT ● An industry-wide campaign to tap the huge potential of the ever-expanding relighting market . . . to increase sales of lighting fixtures, lamps and accessories . . . with major benefits to all groups—manufacturers, distributors, contractors, utilities and users.

HOW ● By boosting consumer consciousness of the need for more and better-quality commercial and industrial lighting—through an integrated and extensive advertising, promotion and publicity campaign, built around the dramatic new Eye-Fi concept.

WHO ● All members of the electrical industry can participate (with Certification included, if desired by the sponsors of the local operation). Materials for hard-hitting, coordinated promotion at all levels, and for product identification, will be provided at cost.

WHEN ● The big new Eye-Fi Relighting campaign will begin with large space advertising, and publicity, in important national magazines, business papers and trade publications early in 1959.

MAKE THIS YOUR PROGRAM.

Find out how you can profit from it. Write to the National Lighting Bureau, 155 East 44th Street, New York 17, N. Y. for further information on

eye-fi RE/LIGHTING

and *Certified* Eye-Fi Relighting

Reynolds Cable-Reel

(*Continued from page* 122)

flanges. Metal strapping which secures the wrapping can be removed quickly.

Reynolds is using the improved packing, which has been thoroughly tested on many shipments, on all orders unless wooden lagging is requested.

PLANT EXPANSIONS

• Hatfield Wire & Cable Div has contracted for a 240,000-sq-ft plant which will have complete facilities for making electrical wire rubber insulation. Located at Linden, N. J., it is part of $7-million modernization program.

• Major warehouse and district sales office will be opened in San Francisco next April by I-T-E Circuit Breaker Co, Philadelphia. Sales and service of low-voltage electrical equipment in northern and central California and for 8 states in northwest U. S. will be accommodated by the $300,000 building.

• Another stock redistribution center, to house the company's central regional and Chicago district offices, has been opened by Edwards Co, Inc in Melrose Park, Ill. The 11,000-sq-ft addition is one of several such facilities the manufacturer of more than 2,000 electrical signaling, communication and protection products has installed recently.

• Manufacturing capacity for Mylar polyester film is to be increased 30% by Du Pont Co, Wilmington, Del. A plant in Circleville, Ohio, will be ready for operation early in 1960.

• A $827,000 facility to be used for turbine rotor balance and overspeed testing will be put into operation by General Electric Co in Schenectady, N. Y. by late 1959.

• New headquarters for the Nuclear Power Division of Allis-Chalmers Mfg Co is located on a 30-acre site in suburban Greendale, Wis. Initial tests are centered on the 66-Mw nuclear power plant A-C is building for Northern States Power Co. Laboratory and administrative facilities occupy about 23,000 sq ft of floor space in two interconnected buildings.

(*More Manufacturers News p* 127)

Whether it's tool belts or safety straps . . . pliers or wrenches . . . grips or climbers, linemen and electricians know they can expect the highest in quality when their equipment carries the name Klein.

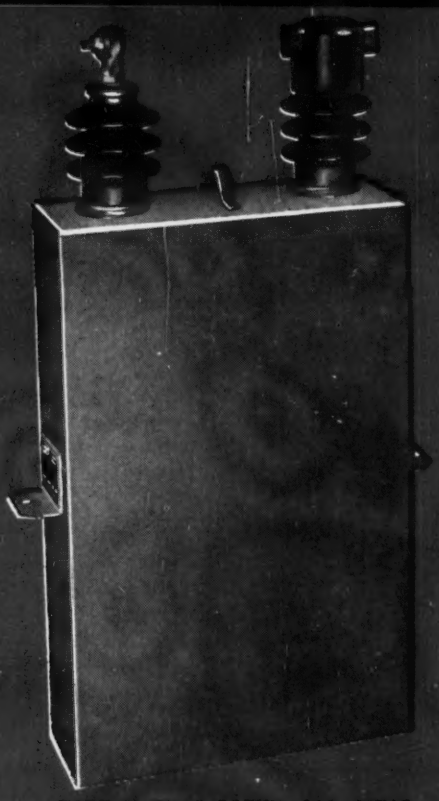
For more than a century Klein has been the leader in designing and producing tools and equipment to serve the exacting needs of the utility field.

Today, wherever power lines or communication lines are strung, Klein tools and equipment are in greater demand than ever, assuring safer, speedier line construction and operation.

WRITE FOR FREE TOOL GUIDE
A free copy of the new Klein Pocket Tool Guide will be sent on request.

ASK YOUR SUPPLIER
Foreign Distributor: International Standard Electric Corp., New York

Mathias KLEIN & Sons
CORMICK ROAD • CHICAGO 45, ILLINOIS



TOBE 50 KVAR POWER CAPACITOR

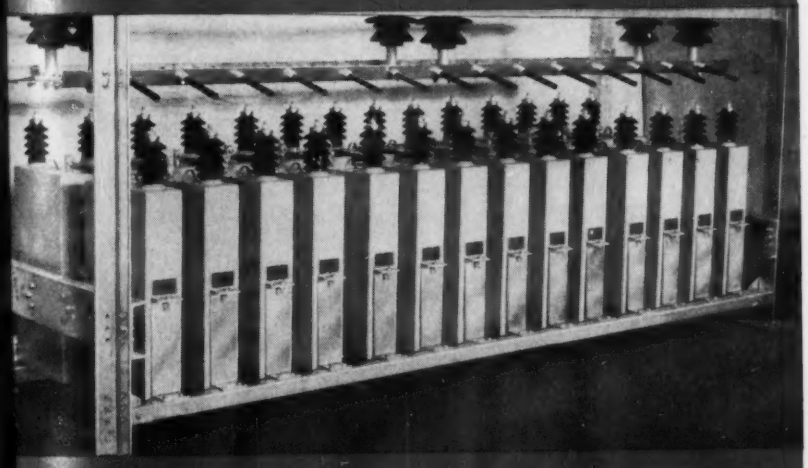
creative engineering

Photograph on opposite page illustrates method of mounting, connecting and fusing of two 14-unit series groups in single frame of Tobe "Varblock" assembly forming one tier of 10500 KVAR, 3-phase, 69KV outdoor, open stack type shunt capacitor equipment. Phase capacity is made up with 5 groups of 50 KVAR, 7980 volt TUMPALL capacitors in series and 14 units in parallel per group.

DESIGNING A VERY HIGH VOLTAGE transmission system is difficult enough when the installation site presents no unusual physical problems. But when the capacitors at that installation must cope with temperature extremes, contamination and shock caused by occasional earthquakes, the task calls for expert assistance ...the kind of assistance Tobe supplied to engineers at this 230,000-volt installation in the West.

Tobe's solutions were just what the engineers ordered ... reliable, long-lasting capacitors, extra-strength porcelain insulators and additional mounting supports. But then, Tobe could be depended on to come up with the "creative engineering" the job demanded—they've been solving similar capacitor research and manufacturing problems for over 30 years. Whether your needs involve high-voltage power transmission or energy storage for thermonuclear reactors for utility use, call in Tobe to look at your specs. TOBE DEUTSCHMANN CORPORATION, Norwood, Massachusetts.

in action



TOBE TEMPALL CAPACITORS

... persistent research, hard-working engineering, rigid production standards.

MANUFACTURERS BRIEFS

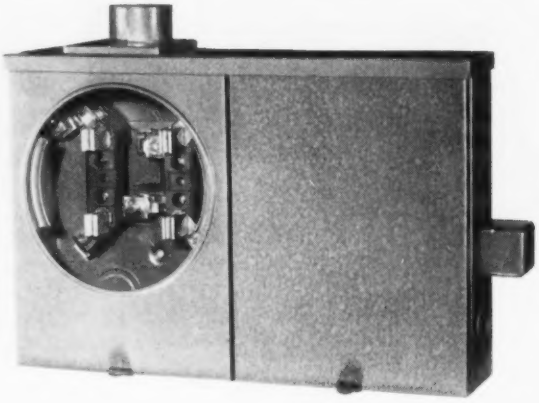
Blaw-Knox Co, Copes-Vulcan Div, Erie, Pa., received an order from Pennsylvania Power & Light Co for a Vulcan Selective-Sequence soot-blowing system for the utility's Brunner Island plant. The system will consist of T-30 retracts with 29-ft travel, RW-3E wall deslaggers, air heater cleaner controls and an SSC-120 control panel. The new Brunner Island steam generator is a Combustion Engineering, pulverized-coal-fired unit, rated 2,100,000 lb per hr at 2,500 psig and 1005/1005 F at the superheater outlets.

Motor Coils Mfg Co, Pittsburgh, has an Epoxi-Mica insulation system for wound armatures up to 1000 hp. The company states that the insulation combines natural mica splittings and solventless Epoxy resin through a vacuum and impregnation process.

Union Carbide Corp's Silicones Div, New York City, reports sales of silicone resin and rubber insulation used by electrical industry, as well as silicone for other industries have picked up noticeably. Wider application of silicone rubber in rotating electrical equipment is expected, along with increased use in dry type transformers for Class H (high temperature) resin systems.

Allis-Chalmers Mfg Co has added to its Hydraulic Division's production facilities the two plants formerly operated by S. Morgan Smith Co in York, Pa. The facilities, totaling more than 350,000 sq ft of production and storage space, will be devoted to continued research, design, engineering and fabrication of a complete line of hydraulic turbines and accessories, pumps, valves, and other hydraulic equipment.

Thomas Industries Inc, Louisville, Ky., anticipates marked increase in sales during the coming year, partly as result of acquisition of subsidiary Benjamin Electric Mfg Co, Des Plaines, Ill. (EW, Jan. 19, p 54). Combined sales are expected to climb to $32 or $33-million, in contrast to $20.3 million for 1958 and $20 million in 1957. Benjamin's plants in Des Plaines, Ill., and Burlingame, Calif., added about 400,000 sq ft to Thomas' facilities.

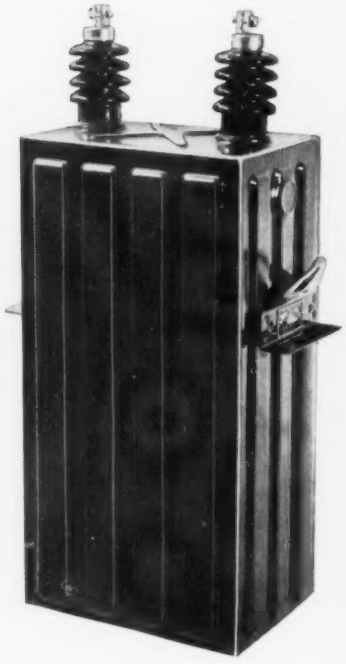


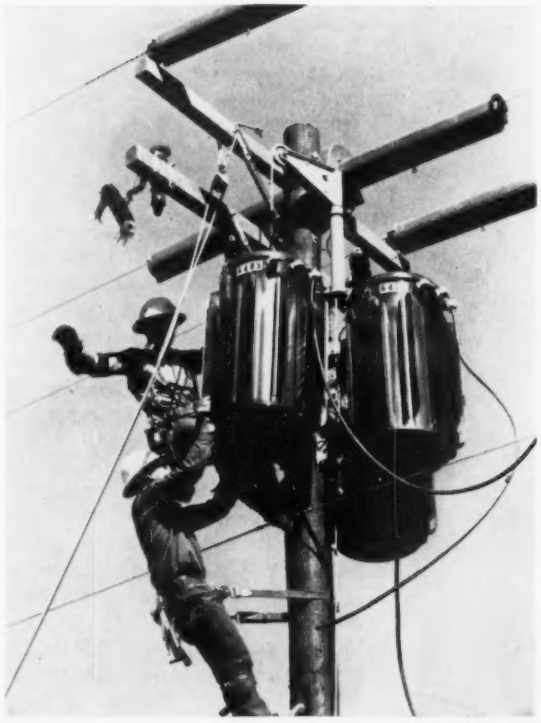
Meter Socket . . .

. . . with either one or two 1-kvar capacitors is preassembled in a standard duplex housing. Designated Type OS (Original Socket), it is an addition to the Secovar line of service entrance type secondary power factor correction capacitors. It is fused and can be furnished with a Klixon thermostat switch if desired.
Sangamo Electric Co, Springfield, Ill.

100-Kvar Capacitors . . .

. . . have cooling ducts in tank sidewalls and ends. At 185 lb, units weigh 15% less per kvar than standard 50-kvar units. Units are rated 2,400 to 7,960 v and meet all applicable NEMA standards for the performance and testing of shunt capacitors. They are impregnated with low-temperature "Elemex" suitable for operation from −40C to +46C. Tanks are stainless steel with solder-sealed bushings for good heat dissipation.
Line Material Industries, McGraw-Edison Co, Milwaukee 1, Wis.





Transformer Hoist . . .

. . . has been redesigned for increased safety. The two-piece MoPeCo hoist is raised by a hand line and assembled at the top of the pole. The base clamps to the pole by means of pole chains and a fast-operating clamp. The aluminum sheaves of the 42-lb unit have been designed to accommodate either steel cable or manila rope. Two workmen can install three transformers in 30 min with the truck operator working the winch line.
Morrison-Pelsue Co, 2256 S Delaware St, Denver 23, Colo.

(*More New Equipment on page* 130)

why buy three?

WHEN 1 WILL DO H

THE HUBBARD

EHD

Look for this emblem. It is symbolic of the Hubbard EHD, the industry's first Single-Vent, Small-Bore Extra Heavy Duty Cutout—a single cutout that will provide positive and safe protection against all fault currents from the point of minimum fuse melting to the maximum rating of the EHD.

SINGLE VENT H EHD SMALL BORE

ONE CUTOUT, the Hubbard EHD Faultmaster, will fill the requirements of Standard, Heavy, and Extra Heavy Duty ratings. Buy ONE! Stock ONE! Inventory ONE! Plan for ONLY ONE!

Providing three capacities with one size means lower cost handling, warehousing, engineering and installation—and with the Hubbard EHD, you still get full range protection from minor overloads through the maximum EHD rating. All this—plus the increased safety of Single-Vent, Small-Bore operation. **Why buy three when one will do?**

HUBBARD

AND COMPANY • 200 SOUTH MICHIGAN AVENUE • CHICAGO 4, ILLINOIS

The design work on all these new substations is going to be hard to handle with our present force.

Of course! They have enough to do handling routine duties. Why don't you call in PIONEER?

GIVE YOUR NON-ROUTINE OPERATIONS TO PIONEER

Design and Consulting Engineering Services

Pioneer has specialized in designing power plants for 57 years. It offers design service for fossil fuel, hydro and atomic plants. It will also assist in forecasting load growth, in site selection, in purchasing and expediting of equipment and in supervising construction. Pioneer's other services include substation, transmission and distribution studies and design.

Services in Regulatory Matters

Pioneer offers its services in all phases of Federal, State and Local regulation including the rate base, depreciation analysis, cost of service studies, market analysis, certificate proceedings and rate of return.

Corporate Services

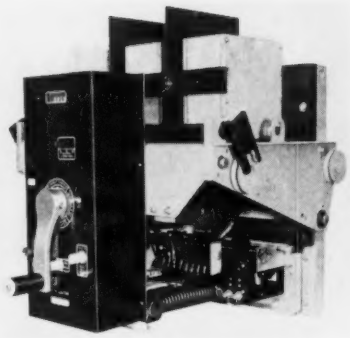
Pioneer's services in corporate matters include business and management engineering advice, financial, accounting and tax counsel and insurance and pension plans and programming. It maintains a complete stock transfer, ledger and dividend disbursement service.

NEW!
On your letterhead, write for 40-page booklet, "Pioneering New Horizons in Power". Describes, illustrates Pioneer's engineering services, and corporate services, from financing to operation.

57 YEARS

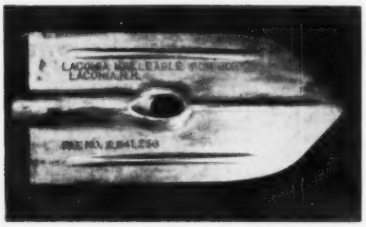
Pioneer Service & Engineering Co.

231 South La Salle Street
Chicago 4, Illinois



Circuit Breaker . . .

. . . is rated at 75,000 amp interrupting capacity at 2,000 and 3,000 amp current carrying capacity. The LA-75A breaker provides both electrically and manually charged stored energy closing mechanisms on each unit. Positive closing, even under maximum fault conditions, is insured by the Amplitork stored energy closing mechanism.
Allis-Chalmers Mfg Co, Milwaukee 1, Wis.



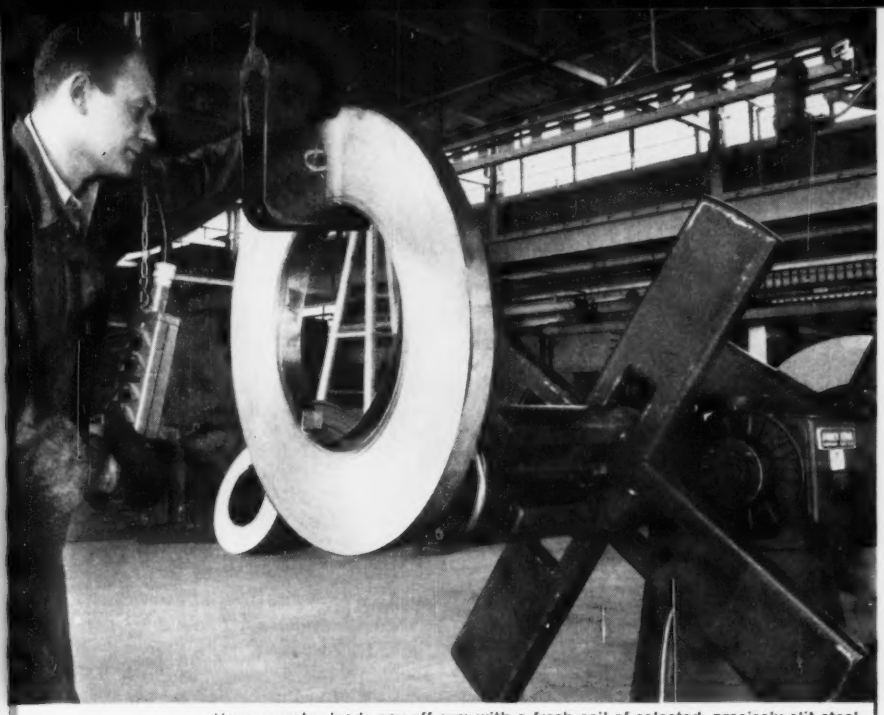
Anchors . . .

. . . hold up to 14 tons. Called "Universal Ground Anchors," the devices are easily hammered to a depth of three or more feet below ground with a pipe-like driving rod. After the rod is removed, a light load is applied on the anchor line to turn the anchor perpendicular to the upward pull. The anchors are made of malleable iron in sizes from 2 to 18 in. They are also available in aluminum.
Laconia Malleable Iron Co, Laconia, N. H.

Reed Vibrometer . . .

. . . **measures the speeds of rotating equipment** where shafts or rotors are not readily accessible. The probe of the Korfund Reed Vi-

(*Continued on page* 132)



Here operator loads pay-off arm with a fresh coil of selected, precisely slit steel.

easier-working CIRTUBE* EMT begins right here with the finest steel!

All the care in the world can't make the kind of EMT contractors like working with — unless the steel's right in the first place.

New CIRTUBE EMT is made with the right kind of steel: specially selected, cold rolled, uniform in quality — and with just the right amount of carbon content for ideal working qualities.

But the right steel isn't enough — proper processing is needed, too. Circle's modern processes are designed to keep in the natural bendability of the high grade steels it selects to make CIRTUBE EMT. Result: tubing that can take it with just the right amount of workability.

Proper steel is only one of many reasons why new CIRTUBE EMT helps get faster, better looking wiring jobs.

Next time you order, try new CIRTUBE EMT — you'll like working with it. Now at your Circle wholesaler's. *Trade Mark

CIRCLE WIRE & CABLE
a subsidiary of
CERRO DE PASCO CORPORATION

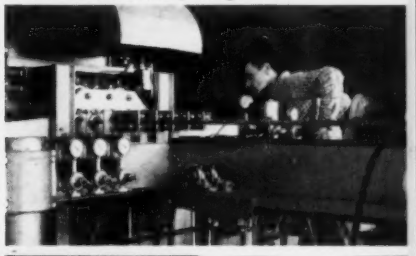
PLANTS: Maspeth and Hicksville, N. Y. **SALES OFFICES & WAREHOUSES:** In all principal cities

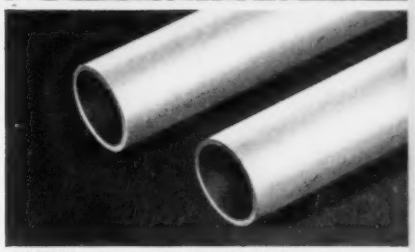
RUBBER COVERED WIRES & CABLES • VARNISHED CAMBRIC CABLES • PLASTIC INSULATED CABLES
NEOPRENE SHEATHED CABLES • "CIRTUBE" EMT

CIRTUBE EMT *Ask for it!*

Split-free, bead-free! Induction welded CIRTUBE EMT, left, proves stronger than ordinary EMT, provides easier fishing.

Easy fishing! A baked-on protective coating gives CIRTUBE EMT a built in lubrication for easier wire pulling.



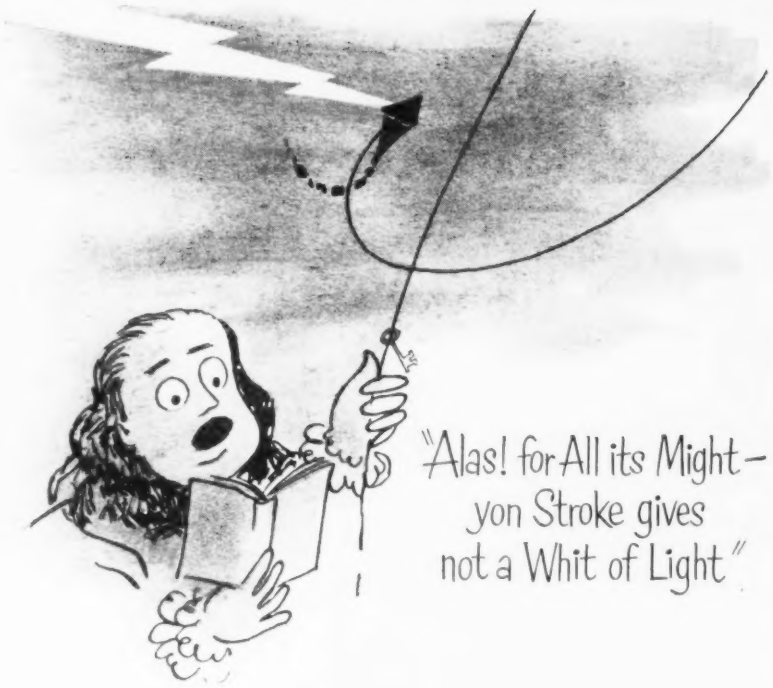


Lifetime exterior finish! Hard galvanized finish for durability; polished satin lustre for lasting good looks.

Automated quality control! Automatic controls assure complete and continuing uniform quality of product.

Tight, easily handled bundles! Bright, orange tapes hold CIRTUBE EMT securely for easy handling on and off the job.

Fast, friendly service! Well-known Circle service through a nation-wide network of well stocked nearby warehouses.



Ben might have been disappointed by the miserly amount of light generated by a first class lightning flash, but it makes *us* happy. It means we don't have to build a long time delay into our photoelectric streetlight controls to prevent accidental turn-off due to lightning. Because "just how bright *is* a lightning flash?" still *is* a question in many minds, here's what we know about it.

Our newest controls – the tubeless 6600A Series – will not turn off until they see at least three or four foot-candles of light for half a second or longer. In comparison, the average lightning flash doesn't begin to reach this light intensity (in the limited vision of the control) – and rarely lasts more than *0.001 of a second*. The real clincher, though, is what has happened in the field. About 2000 F-P controls, some with a half-second delay and the rest with *no* delay, have been through two annual seasons of electrical storms in typical utility service. *The number of accidental turn-offs has been zero!* Where headlights, sign lighting and the like are a possible threat, directional F-P controls can be aimed a few degrees away from these sources.

By keeping time delay down to half a second – installers can check out their work and the control as fast as they can put their hand over the control's window, saving both time and money. Short delay also eliminates waiting periods and false readings when controls are inspected and calibrated back in the shop. And a control without a special delay circuit in it is that much easier to build – and cheaper to buy.

Fourteen years ago we thought a six- or eight-second delay was vital, and took the trouble to see that F-P controls had it. Times have changed, controls are up higher on the pole, and a control for each lamp is more and more the practice. It just doesn't seem sensible anymore to make a control shut its eyes to an evil that no longer exists. The Fisher-Pierce Co., 82 Pearl Street, So. Braintree 85, Massachusetts.

FP

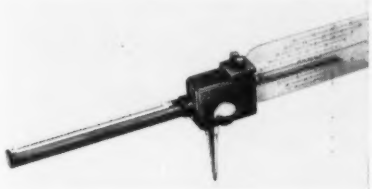
FISHER PIERCE

PHOTOELECTRIC LIGHTING CONTROLS

AN AFFILIATE OF SIGMA INSTRUMENTS, INC.

Reed Vibrometer

(*Continued from page* 130)



brometer is placed against the machine housing. It has a reed in the form of a steel strip whose effective length can be varied by a knob on the side of the instrument. When the natural frequency of the reed coincides with that of the disturbance being tested, the reed will vibrate strongly in resonance. The output can be attached to an oscilloscope if desired.
Korfund Co, Inc, 48-21H 32nd Pl, Long Island City 1, N. Y.

Stacking Insulator . . .

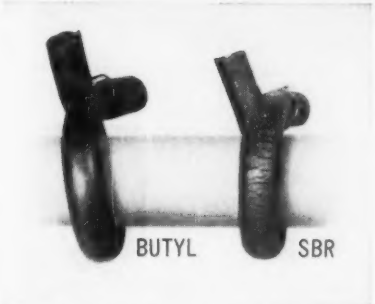
. . . is available in brown or gray glaze. The No. 23333 high strength switch and bus insulator is light weight and completely interchangeable with the standard No. 7785. The availablity of a single unit usable for either standard or high strength replacement reduces stock investment.
General Electric Co, Box 57, Baltimore 3, Md.

Recorder . . .

. . . is designed to operate with transducers having a total resistance between 1,000 and 10,000 ohms. The Speedomax Type H instruments can indicate and record measurements of pressure, flow and other variables
(*Continued on page* 134)

ENJAY BUTYL

FOR RESISTANCE TO SUNLIGHT AND WEATHERING



Butyl's high resistance to ozone is graphically demonstrated when compared with SBR or natural rubber

Enjay Butyl rubber has demonstrated for many years its outstanding ability to resist deterioration caused by sunlight and weathering. This inherent resistance of Butyl to ultra-violet light, ozone, oxidation, moisture and mildew, has made possible many new and colorful products. Butyl has also increased the life of other products such as weatherstrips, protective coating, garden hose, wading pools and many automotive parts.

Butyl *also* offers...outstanding resistance to chemicals, abrasion, tear and flexing . . . superior damping qualities . . . unmatched electrical properties and impermeability to gases and moisture.

For more information call or write the Enjay Company.

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Korfund ..... Vibrometer ☐
GE ..... Insulator ☐
Leeds & Northrup ..... Recorder ☐
Hubbard ..... Insulator Pins ☐
Tork ..... Time Switch ☐

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Specs ..... ☐
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FEBRUARY 23, 1959

Recorder

(Continued from page 132)

detected by 3-terminal potentiometer type transducers. They are supplied in either round or strip-chart models.

Leeds & Northrup Co, 4939 Stenton Ave, Philadelphia 44, Pa.

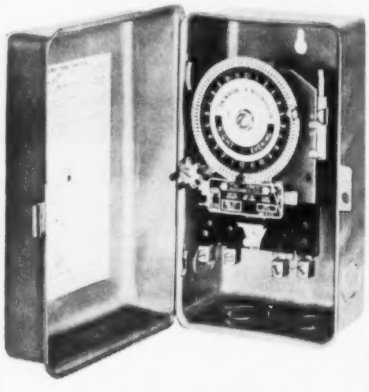
Insulator Pin . . .

. . . has rounded wrench hold corners that prevent danger of wear and damage to conductors being pulled across the pin base. Known as No. 22981, the pin is made of high-strength Cor-Ten alloy steel. It is galvanized and particularly adaptable to regions of highly corrosive industrial atmospheres or sea coast areas.

Hubbard and Co, 200 S Michigan Ave, Chicago 4, Ill.

Time Switch . . .

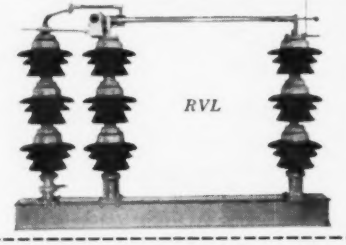
. . . for switching two heavy loads is available as a standard model. The two-circuit switch will turn two lighting circuits on at one time and turn them off independently. Known

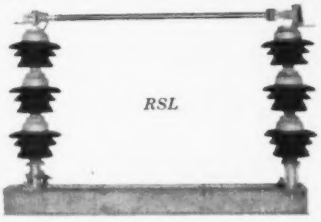


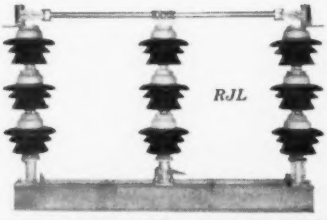
as Model 1196, the switch has a "Reserve Power" feature which keeps the time switch in "on time" operation in case of power failure. No readjustment of time controls is necessary when power is restored.

Tork Time Controls, Inc, Mount Vernon, N. Y.

GROUP OPERATED SWITCHES





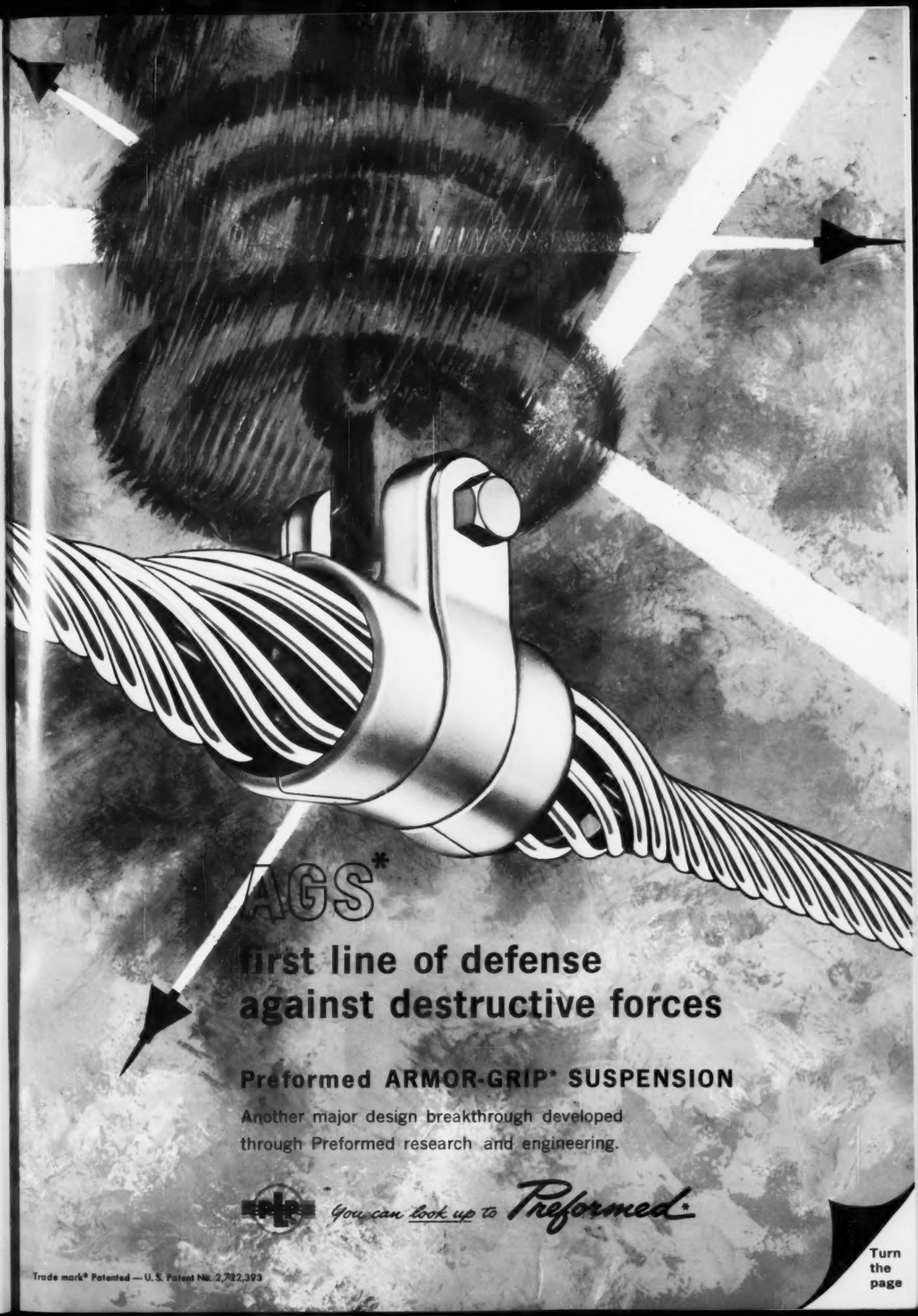


ROYAL *DESIGN FEATURES* GIVE PEAK PERFORMANCE

- **Contacts are High Pressure Line Type with silver tungsten "ELKONITE" inserts.**
- **Leading edges of blade wipes into contact providing a self-cleaning action.**
- **Bearings are used at all points of movement eliminating maintenance.**
- **Multiple leaf Beryllium copper contacts provide maximum thermal and short time current capacity.**
- **Quality materials and simplicity of operation for long life.**
- **All switches available in ratings from 7.5 to 161 kv and from 400 to 1200 amp.**

For full details, write for a copy of the RVL, RSL or RJL Royal Bulletin.

ROYAL
ROYAL ELECTRIC MANUFACTURING CO., INC.
1122 EAST 87TH STREET • CHICAGO 19, ILLINOIS
Designers and Manufacturers of
Power Switching Equipment and Special Electrical Devices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against destructive forces
Preformed ARMOR-GRIP* SUSPENSION
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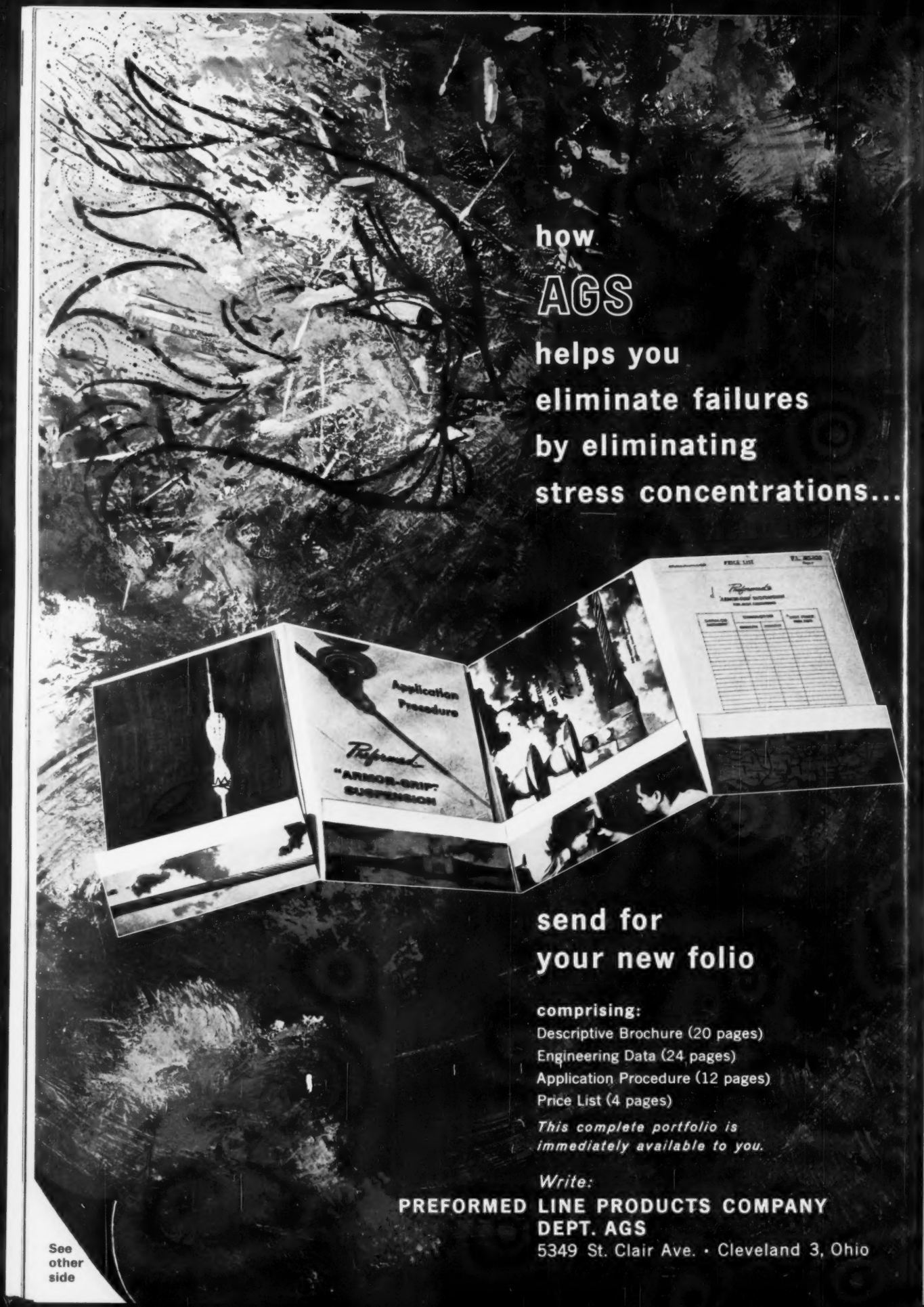
You can look up to Preformed.
Trade mark* Patented — U. S. Patent No. 2,722,393
Turn
the
page


how
AGS
helps you
eliminate failures
by eliminating
stress concentrations...
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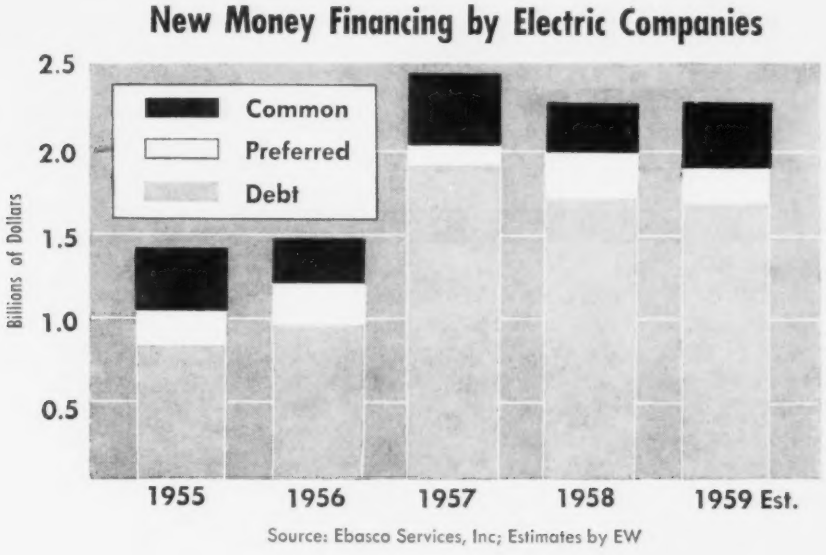


Source: Ebasco Services, Inc; Estimates by EW

Report on
Financing

What's Ahead in Money Markets?

1959 looks like another busy year for electric utility financial men. Not only will the total volume of new money financing probably run very close to last year's high level, but the money markets show no signs of having lost the volatility that marked their behavior during 1958.

Yields on new Aa-rated utility bonds soared from around 3.6% early last year to 4.5% by Christmas, and have fluctuated near there since. Electric utility common stock yields, meanwhile, have dropped as rapidly as bond yields have risen. Moody's averages show that seasoned Aa's have yielded more than commons since September. On Feb. 17, Aa's led the stocks by about 40 basis points.

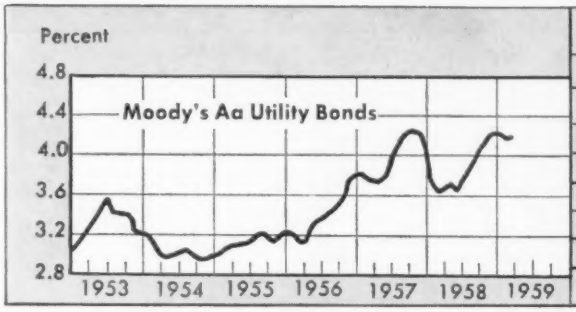
This inversion of yields points up the uncertainty of the 1959 money markets, never a model of clarity at best. Will this year witness a continuation of these diverse trends—lower rates for equity money and higher rates for bonds, debentures, and preferred stocks? Or will either of these trends reverse?

The Bond Market

Simply stated, it's unlikely that bond yields will go down, and they may go up still further. Consider supply and demand. New debt financing by the electric utilities will probably end up a bit below last year's $1.767 billion total. But electric companies must compete with railroad and industrial corporations for the important institutional market. Real estate mortgages are also competitive. True, the total new corporate bond financing is not likely to increase over last year, and mortgages pose no serious threat to bonds yielding close to 4.5%. But competition doesn't end there.

U. S. government securities of reasonably long term are also competitive. In fact quite a convincing case can be made to prove that over the past five years Washington has provided most of the impetus to drive up utility bond yields. Tightening of credit by the Federal Reserve Board has been one factor. The

Bond Yields: Through the Roof?



	New Long-Term Financing ($ Billion)		
	Federal	Corporate	Total
1953	1.6	8.0	9.6
1954	0	6.8	6.8
1955	2.7	8.0	10.7
1956	0	9.7	9.7
1957	1.3	11.8	13.1
1958	2.9	10.0	12.9

other, even more important, is the offering of large amounts of new long-term debt securities by the U. S. Treasury. A look at the record bears this out.

Early in 1953, when Aa-rated electric utility bonds could be marketed successfully at about a 3.2% yield, the Treasury decided to "stretch out" its debt by offering some $1.6 billion in long-term bonds. As a result the bond market was disorganized, and Aa-rated utilities rose in yield to 4% in about three months. But the condition was not permanent. After the peak in June, the Aa's dropped back to their former yields before the end of the year, and yields stayed low until the winter of 1956-57 when a temporary oversupply of corporate bonds shot them up again. No sooner had the market righted itself than the FRB and the Treasury joined forces to drive them up once more—this time to the highest levels in thirty years. The Fed, in an effort to curb inflation, hiked the rediscount rate to 3½% and otherwise tightened credit. Treasury offered more than $600 million of long-term bonds.

Still groggy from this combination of blows, further weakened by the recession and by an oversupply of corporate issues in early 1958, the bond market sank to the canvas last spring when the Treasury offered another $2.85 billion in long-term securities. It has not recovered since. Although this $2.85 billion was new money, the chances are that any long-term government refunding of short-term indebtedness will also have adverse effect on the bond market.

What does this portend for electric utility issuers in 1959? First, a prediction of Federal Reserve Board policy can be little more than a guess. Political criticism of the Fed's tightening credit just as the recession was beginning makes it unlikely that the screws will be tightened any further unless we have a sizeable boom. But it seems wishful thinking to anticipate any action this year designed to reduce interest rates. Best guess is continuation of the status quo.

The other question mark—Treasury policy—is equally unpredictable. A sobering total of more than $70 billion is due to hit the market during the remainder of 1959. Of this, new money is estimated at about $5 billion, and there is no doubt that this could further injure the corporate market if any sizeable percentage is in long-term issues. An $850-million long-term offering early in January was enough to send yields on utility Aa's up from 4.45% to 4.62%. Significantly, however, the Treasury's $15-billion refunding later in the month included no maturities longer than three years.

The Treasury's recent unfortunate experience in the long-term market may well cause it to move cautiously in bringing any large offerings of this type to market, either for refunding or new money. So little "stretching" of the debt can be accomplished (even a switch of $5 billion from short term to long would change the ratio by no more than 2%) and so much harm could be done to the market by such a switch, that the game seems hardly worth the candle.

What should utilities do? There's nothing on the horizon to indicate a wholesale deferral or acceleration of offerings. But the utilities will find it worth while to keep up not only with the corporate market, but the Treasury market as well. As a minimum, utility managements should make sure they find out the dates and amounts of federal offerings well in advance—and reschedule their own if the dates conflict. For instance, if a large federal offering were planned for mid-June, and the company had planned to offer its bonds late in June, it might be advisable for the company to move its offering date forward to the middle of May—in order to beat any formal announcement by the Treasury of the terms and maturities of its impending securities.

The Stock Market

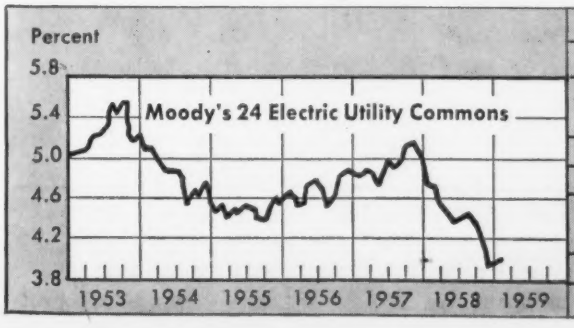
Electric utility common stocks rode into 1959 on a rampaging bull market. Yields stood at a 20-year low; Moody's 24 electric utility commons averaged 3.87%. For this year, forecasters are nearly unanimous in predicting at least moderate improvement in all lines of business; and electric utility earnings prospects look particularly bright. If the stock market always reacted in a logical manner in keeping with current business news, a further rise in stock values might be considered almost certain this year.

But the market does not always act in a logical manner. Just as the bad news of 1958 was discounted on Wall Street, the good news of 1959 may be discounted. Tradition has it that when bond yields rise, dividend yields on stocks will rise also. The representative of one large brokerage firm points out that a sharp drop in bond prices is "almost inevitably" followed within a year by a "sympathetic" decline in stock prices. If past experience should be repeated, the stock market could be reaching a vulnerable position by spring.

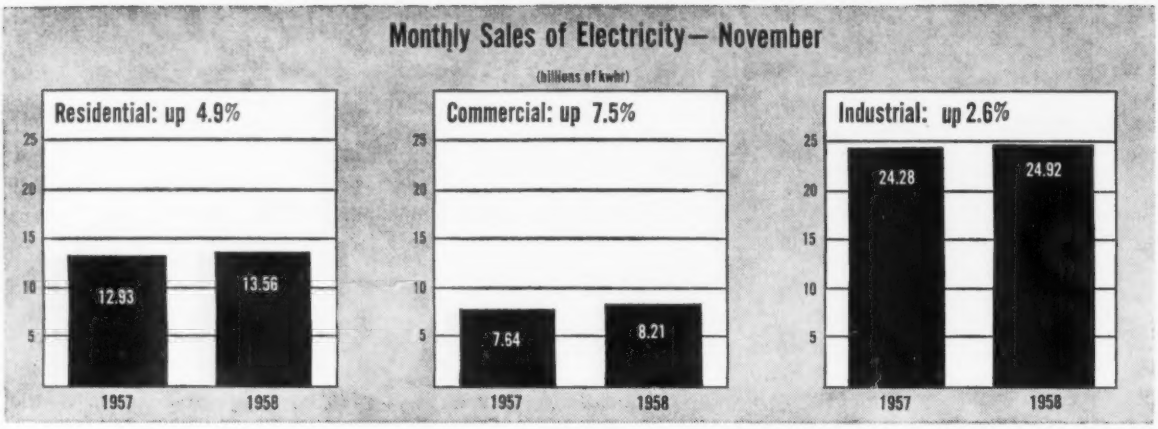
The utilities retain the strong factor of stability, plus a record of perennially improving earnings, and 1959 is liable to see a substantial number of dividend increases. Danger to the utility stocks is most likely not from any shortcomings of the industry in 1959, but rather as a carryover from any break in the industrial market. As one analyst irreverently put it: "People sell the good stocks so they can hang onto the dogs." This danger is no less real because it is indirect.

The wisest course for power company financial managers, in the face of divided opinion as to what the stock market is going to do in 1959, may well be to take advantage of current high prices for electric utility stocks, and accomplish promptly whatever equity financing looms in the not too distant future. Better prices may be obtainable for electric utility shares later in 1959; but if these shares are sold now, the level of current prices should be high enough to gratify the issuer and reconcile interested parties to the action taken.

Stock Yields: Through the Floor?



Inflation (GNP Price Deflator: 1957 = 100)												
1953	1Q	90.8	1955	1Q	92.8	1957	1Q	98.8
	2Q	90.8		2Q	93.1		2Q	99.6
	3Q	91.2		3Q	93.7		3Q	100.7
	4Q	91.2		4Q	94.1		4Q	101.1
1954	1Q	92.0	1956	1Q	94.8	1958	1Q	101.9
	2Q	92.0		2Q	95.6		2Q	102.4
	3Q	92.2		3Q	96.6		3Q	102.5
	4Q	92.5		4Q	97.6		4Q	102.7



Power Statistics

		Latest Month	Year Ago	Annual Change %
Capacity	Nov.	139.19	127.51	9.2
Peak—Class I Systems (million kw)	Dec.	107.1	102.4	4.6
Estimated Dec. '59 Peak (million kw)	Nov.	127.4	131.8	− 3.3
Production—billion kwhr	Nov.	53.92	51.77	4.2
Hydro		10.55	10.90	− 3.2
Fuel		43.37	40.89	6.1
Sales—billion kwhr	Nov.	49.26	47.28	4.2
Residential		13.56	12.93	4.9
Commercial		8.21	7.64	7.5
Industrial		24.92	24.28	2.6
Other		2.57	2.42	6.2
Fuel Consumption	Nov.			
Coal—million tons		13.50	13.64	− 1.0
Oil—million barrels		7.58	6.72	12.8
Gas—billion cu ft		102.25	92.16	10.9
Net Income Class A & B Co's—$ million	Nov.	128.16	113.98	12.4
Residential Customers—millions	12 mos.	47.69	46.77	2.0
Revenue per kwhr	ended	2.53¢	2.56¢	− 1.2
Avg kwhr per customer	Nov. 30	3,353	3,156	6.2
Avg annual bill		$84.83	$80.79	5.0

Business Statistics

Indexes: 1947–49 = 100				
FRB Industrial Production	Jan.	142	132	7.6
ENR Construction Cost	Feb.	163.3	155.9	4.7
BLS Cost-of-living	Dec.	123.7	121.6	1.7
New Orders for Machinery (1950 = 100)	Dec.	146	128	14.1
NEMA Sales				
Insulation materials	Nov.	122	123	− 0.8
Electric appliances		94	88	6.8
Wholesale prices				
Motors and generators	Nov.	146.4	143.0	2.4
Transformers and regulators		148.8	150.8	− 1.3
Switchgear and fuses		172.1	171.2	0.5
GNP—annual rate—$ billion	4th qtr.	453.0	432.6	3.2

Significant changes: November hydro production fell below year-ago levels for the first time in almost two years. The coal burn rose, and oil use moved to its highest point since January 1957.

powerful appetite!

As utilities *look* ahead and *build* ahead for a power demand in ten years double what it is today—continuity of supply and proven, available coal reserves are topmost subjects in discussions with their suppliers. A career coal company such as Island Creek with its vast reserves,* modern mining methods and scientific preparation facilities is in a position to come up with some very reassuring answers. We'd welcome an opportunity to do some looking ahead *with you.*

* *Island Creek's vast, proven, available reserves total more today than Island Creek has taken out of the earth in the past 50 years.*

You can depend on **ISLAND CREEK**

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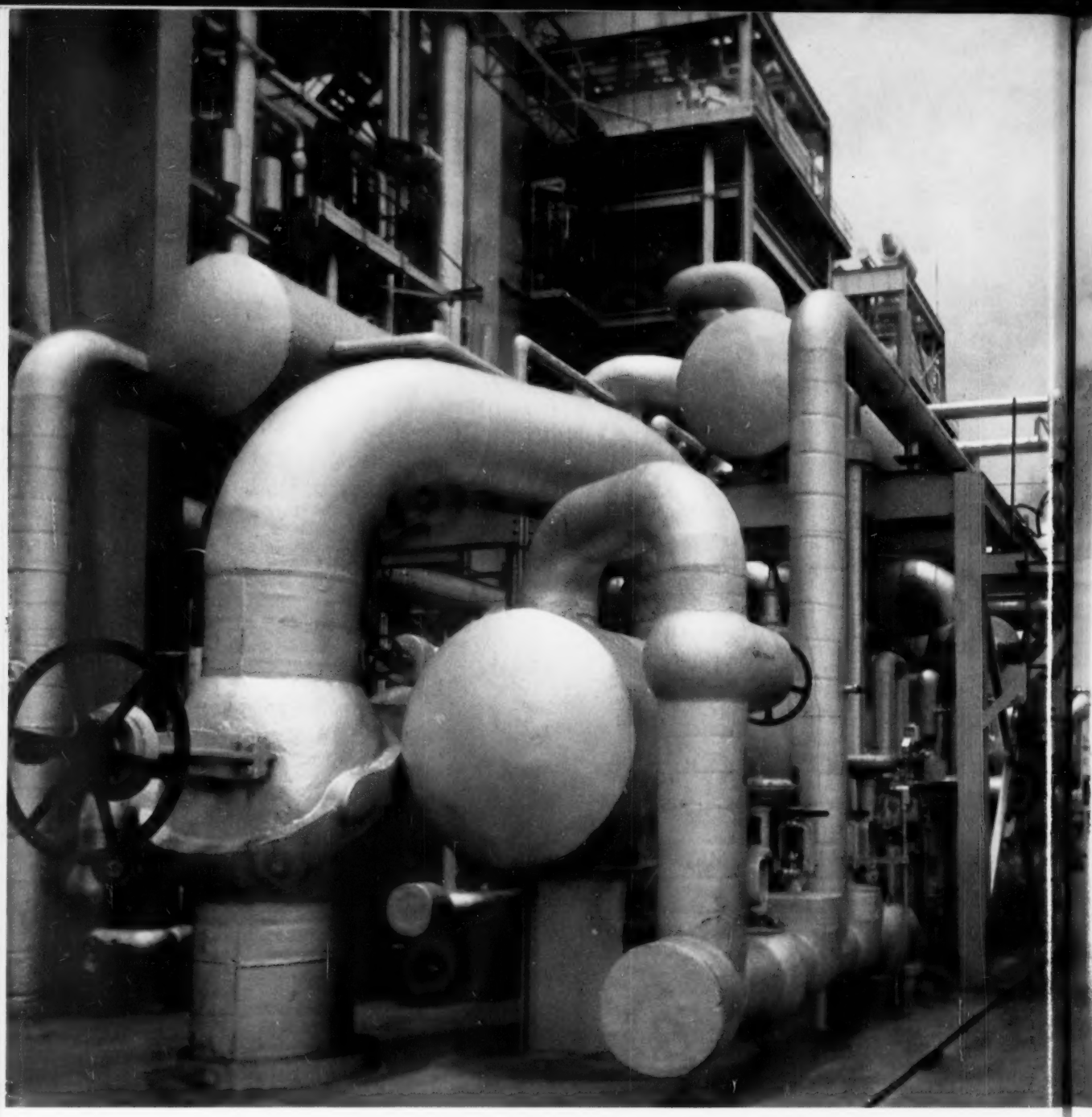


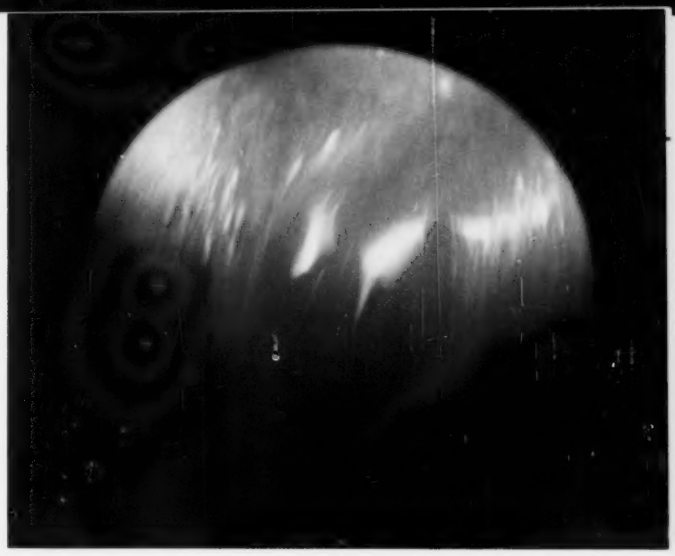
After 10 years of service, Gulfcrest oil still

In December 1948, Florida Power & Light Company at their Cutler plant put into operation the first two of six turbine-generators with a total capability of 400,000 kw. All six units were filled with Gulfcrest—the long-lasting, anti-rusting, non-foaming turbine oil. The Cutler plant uses Gulf lubricants exclusively.

Ten years later, after a total of 350,400 turbine operating hours, samples of the oil showed it to be well within the original formulation specifications . . . surprisingly close to the specifications for new oil.

Laboratory analyses of the Gulfcrest oil showed:

	ORIGINAL PROPERTIES	AFTER 10 YRS. SERVICE
Color, NPA	1¼	1½
Flash point, °F.	410	420
Appearance	Clear	Clear
Water, % by volume	0	0
Viscosity, SSU at 100°F.	151	153.2
Neutralization	.04	.04
Interfacial tension, dynes per cm at 77°F.	24	31
Steam emulsion number	100	105
Rust prevention test, 24-hr. distilled water	Bright—passes	Bright—passes



Proof by color. After 10 years of service, samples of Gulfcrest showed NPA color rate of 1½—one of many proofs that the oil hasn't deviated from its original characteristics.

Gulf representative J. S. Bailey, right, discusses general operations with an official of Florida Power & Light Company.

Outdoor power plant. Florida's mild weather makes possible this unusual outdoor installation where Gulfcrest lubricates all six turbines.

within original specifications . . .

This plant can expect many additional years' service from this oil without marked change from present analysis. In many large turbines Gulfcrest has served continuously up to 20 years with neutralization numbers still low, systems still free from sludge and rust.

Every performance record of Gulfcrest proves that Gulf makes things run better. Small wonder that in Gulf's marketing area, more power is generated by central station steam turbines lubricated with Gulfcrest than with any other oil.

More information? Write for illustrated booklet.

GULF OIL CORPORATION
Dept. DM, Gulf Building
Pittsburgh 30, Pa.

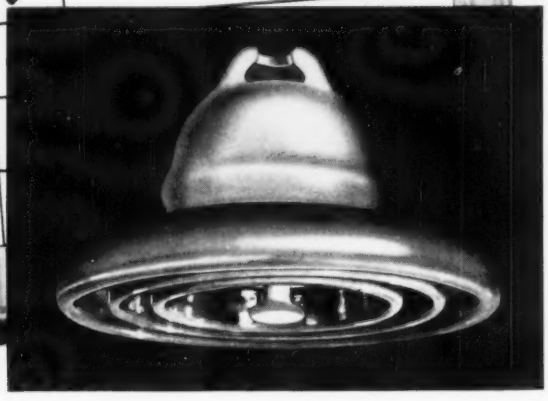
GULF MAKES THINGS RUN BETTER!

GULF

SP-9470

21 CONTROLS BY DELTA-STAR ASSURE YOU A QUALITY INSULATOR EVERY TIME

✓	1. **RAW MATERIAL**—control of moisture, shrinkage, screen analysis and slump.	✓	13. **VISUAL INSPECTION**—control for cracks and flaws due to firing.
✓	2. **FORMULA WEIGHT**—control of mixture by automatic tape recording.	✓	14. **DYE-PENETRATION TEST**—controls vitrification.
✓	3. **CLAY "SLIP"**—control of viscosity, Sp.Gr., pH, sulfate content.	✓	15. **HIGH-FREQUENCY TEST**—controls puncture-proof porcelain.
✓	4. **PARTICLE SIZE**—control to eliminate impurities and assure uniformity.	✓	16. **60-CYCLE TEST**—controls puncture-proof porcelain.
✓	5. **MAGNETIC SEPARATOR**—control to remove ferrous particles.	✓	17. **MECHANICAL TESTS**—control for loading characteristics.
✓	6. **FILTER PRESS**—control for shrinkage, thermal expansion, and body strength.	✓	18. **CEMENT TEST**—control of hardware-to-porcelain bonding material.
✓	7. **VACUUM PUG MILL**—control of de-airing and moisture content.	✓	19. **FINAL INSPECTION**—control for dimensions, alignment, and product quality.
✓	8. **UNFIRED WARE**—control for dimensions and surface finish.	✓	20. **CERAMIC LAB**—controls factory production ceramically.
✓	9. **"Q.T." TREATMENT**—control of rf interference material. A Thomas invention.	✓	21. **TESTING LAB**—controls factory production mechanically and electrically.
✓	10. **GLAZE APPLICATION**—control of thickness and deposit viscosity.		
✓	11. **SAND BAND**—control for bond strength and uniformity.		
✓	12. **KILN**—control of firing process.		



DELTA-STAR PORTER ***ELECTRIC DIVISION***

H. K. PORTER COMPANY, INC.

For full catalog information on Delta-Star suspension insulators, write for publication #1000 to *Thomas Works, Delta-Star Electric Division, H. K. Porter Company, Inc., Lisbon, Ohio.*

DIVISIONS: Connors Steel, Delta-Star Electric, Disston, Forge & Fittings, Leschen Wire Rope, Moulding, National Electric, Refractories, Riverside-Alloy Metal, Thermoid, Vulcan-Kidd Steel, H. K. Porter Company (Canada) Ltd.

Delaware P&L To Relight Wilmington

A street lighting program which will eventually relight the whole city —arterial streets, business districts, and residential areas—has been undertaken by the city of Wilmington, Del.

The entire schedule will result in a 300% improvement in the total lumens generated on the city streets for an approximately 18% increase in annual cost, according to Delaware Power & Light Co.

The first phase of the extensive program was to relight Fourth Street, a distance of approximately two miles, with 116 fluorescent-mercury luminaires attached to 8-ft brackets, mounted at 28 ft above the 60-ft wide thoroughfare, (see photo). Average maintained ft-c level is now 1.5 to 2.0.

The next step will relight the downtown business district with similar street lighting equipment. This phase of the program consists of lighting approximately 58 city blocks with 181 additional 20,000-lumen fluorescent-mercury units and is presently being completed.

In addition to the extensive business district relighting program, city fathers have also authorized the improvement of the residential lighting areas. This program calls for the replacement of approximately 1,500, 100-cp incandescent lamps with 250-cp incandescent lamps.

Most recently Delaware P&L has been authorized by city officials to completely illuminate one of the arterial feeder streets with 400-w, 20,000-lumen flourescent-mercury type lamps. It was previously equipped with 10,000 lumen lamps.

The new lamps have 2,000 candlepower, twice as much as the 25-yr old incandescent lamps they will replace.

Wall Panel Will Light and Heat or Cool

A full-scale wall panel which will light and heat or cool a home at the same time has been unveiled by Westinghouse Electric Corp.

The "hot-cold-light" panel is the result of combining two of the latest technological advances into a single operating unit, according to Chris J. Witting, vice president and general manager, consumer products. They are: Thermoelectric heating and cooling, and electroluminescent lighting.

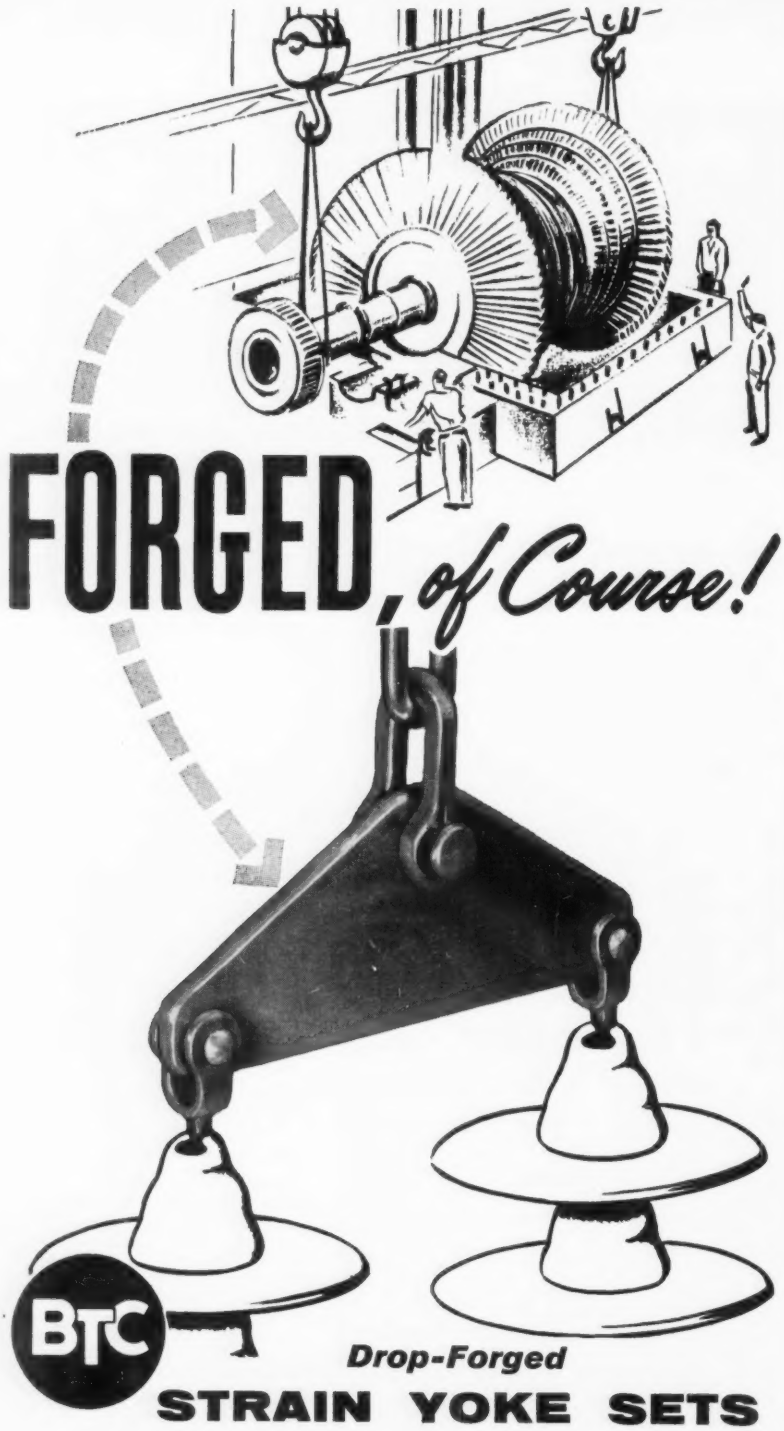
The 6 by 4-ft panel responds to a set of dials which can change temperature from a low of 55F to a high of 120F, and vary the intensity and color range of the light source. Part of the thermoelectric assembly is superimposed in artistic designs or "mobiles" of anodized aluminum in front of the electroluminescent screen of the panel. These mobiles serve to heat or cool the air of the room. The remainder of the thermoelectric assembly is hidden behind the screen.

Westinghouse will not introduce the panel commercially at this time.

Electric Range Information Center Established

Eleven range manufacturers have banded together to support a new national communications center designed to educate consumers on the superiority of electric cooking. They are: Admiral, Frigidaire, General Electric, Hotpoint, Kelvinator, Monarch, Norge, Philco, Tappan,

(*Continued on page* 146)



Superior resistance to shock and fatigue
Forged plates with full radius (corona free) edge
Specify the best—BTC Hi-Line Hardware

THE BREWER-TITCHENER CORPORATION
HI-LINE HARDWARE DIVISION • CORTLAND, N.Y.

Electric Ranges

(*Continued from page* 145)

Westinghouse and Whirlpool.

The National Electrical Manufacturers Assn will sponsor the center whose program theme will be, "The Big Change Is To The Electric Range."

"Miss Nancy Nema" has been selected as a symbol to tell the story of electric cooking advantages, and head the electric range information program which will be directed chiefly at communication outlets, home economics teachers and other professional home economists.

The center's information service will also provide periodic industry statistical reports to business editors, researchers, etc, and provide data from continuing tests to demonstrate the speed, economy and cleanliness of electric cooking.

Brochures, display banners and an 8-p newspaper supplement are being prepared as part of a coordinated year-long program.

Lack of Electric Heat Promotion Scored

Without electric heat as the foundation of the electrical industry, tremendous inroads from natural gas will be made in the heating and appliance fields, according to M. R. Van Zanten, advertising director of Swan Manufacturing Co. "If gas companies get the heating, time will soon take care of the rest—they will change everything operating on electricity to operate on gas," he warned the annual sales meeting of the Southwestern Public Service Co last month.

By concentrating on selling only 60 w of lighting, utilities are walking away from a potential sale of 1,500 w of heat for the same space, he said. He also scored "lack of enthusiasm" on the part of many utilities to promote electric heat.

Van Zanten outlined these methods for pushing electric heat:

- Promotion should stress safety, cleanliness and comfort as selling tools, with "electric heat safety" as the unit of measurement.
- Don't drive the potential market away by telling customers their homes have to be built like a vault before they can heat with electricity. Recommend insulation, but *sell*

electricity, he said.

- Put in enough heat for permanent efficiency.
- Lower the heat rate whenever possible, and if necessary raise the general use rate.
- Cooperate with the electrician or specialty man.

IES of England Observes 25th Anniversary

The Illuminating Engineering Society of England is celebrating its 50th anniversary this year.

Plans for the celebration include: A Jubilee Commemoration Dinner; meetings with the Institute of Electrical Engineers, Electrical Contractors Assn, optical and women's electrical associations, and with architects. Lighting displays have been arranged at electricity service centers, and lectures are being given to chambers of trade, rotary clubs, schools, and colleges.

Electric Cooking Display

"The last word in electric cooking" is featured in a commercial kitchen set up in the windows of the Atlantic City Electric Co. The kitchen features, heavy-duty broilers, deep fryers, a new-type trunion kettle, high-speed pressure cookers, etc. While the kitchen was installed specifically for the benefit of restaurateurs, it is open to the public.

testing motor overload relays?

Test any protective device faster with Multi-Amp! Confines instrumentation to a single enclosure, greatly reducing "set-up" time. Safe and entirely portable. Get the facts from Jim Bates by phone or mail!

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Planned Electrical Maintenance Program

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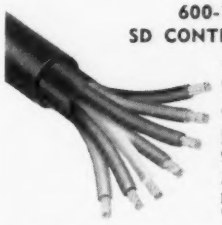
"Continuous power for continuous production"

SUPERIOR POWER and CONTROL CABLES

Insulated and jacketed with modern plastics

600-1000V SD CONTROL CABLE

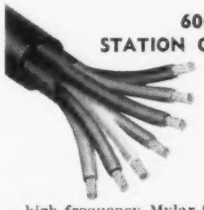


Flexible stranded conductors insulated with polyethylene. Nylon jacket over insulation provides extra protection. Mylar tape over cabled conductors, polyvinyl chloride outer jacket.

POLE & BRACKET CABLE

For use from street lamp base or overhead circuit to lighting fixture. Insulation is polyvinyl chloride, jacket is polyethylene. Operates at relatively low voltage between conductors, high voltage from conductors to ground.

600-1000V STATION CONTROL CABLE

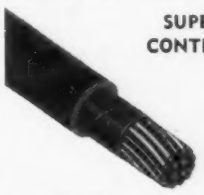


Conductors insulated with polyethylene. S. I. C. rating (2.3%) and Power Factor rating (.0003) remains constant at high frequency. Mylar tape over cabled conductors, polyvinyl chloride jacket overall.

FIGURE 8 POLE & BRACKET CABLE

For 0-600V service. Insulated with polyvinyl chloride. Does not deteriorate with age or weather, resists abrasion and mechanical damage, is not affected by common chemicals nor electrolysis. Will not support combustion.

SUPERVISORY CONTROL CABLE



Conductors polyethylene or polyvinyl chloride insulated. Polyethylene or polyvinyl chloride jacket. With or without shielding. Color-coded to IPCEA specifications or as desired. Composite types with twisted pairs available.

CATHODIC PROTECTION CABLE

Polyethylene insulation with polyvinyl chloride jacket or special polyethylene jacket. Highly resistant to most acids, alkalies and chemicals usually found in corrosive soil areas.

STREET LIGHTING CABLE

Thermoplastic series lighting cables for direct burial, in ducts or overhead. Highly resistant to earth acids and alkalies, moisture, sunlight and weather. With either polyethylene or polyvinyl chloride insulation and either polyethylene or polyvinyl chloride jacket. Shielded types available.

BUS DROP CABLE

Designed especially to provide flexible branch circuit runs between overhead bus feeders to shop and plant equipment. Conductors are color-coded. Insulation and jacket are polyvinyl chloride.

SUPERIOR CABLES are manufactured under a rigid quality control system and are thoroughly tested prior to delivery to assure satisfactory performance.

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SUPERIOR CABLES

SUPERIOR CABLE CORPORATION

Hickory, North Carolina

3465

PS of New Mexico Promotes Two Officers

SCHREIBER

Two officers have been promoted by Public Service Co of New Mexico. George A. Schreiber has been appointed executive vice president and M. C. Heffelman was made senior vice president.

Schreiber, who had been administrative vice president, has been with Public Service since 1949. Starting in the sales department, he has held a number of positions including the vice presidency of the main division in Albuquerque.

Heffelman, who will be responsible for design, construction, and operation of power plants and for power production operations, joined PS of New Mexico in 1932. He was made vice president of the company in 1946, while in the Santa Fe division, and joined the company's main division in 1951.

HEFFELMAN

GE Makes Major Appointments

McCUNE

FINK

General Electric Co has made four major appointments. Francis K. McCune becomes vice president-atomic business development and Dr. Lyman R. Fink succeeds him as general manager of the Atomic Products Division. Lewis J. Burger has been named general manager of the Switchgear and Control Division and George E. Burens succeeds Donald L. Millham as general manager of the Lamp Division. Millham becomes a consultant.

McCune was appointed general manager of the Atomic Products Division in 1953 and was elected a vice president a year later.

Dr. Fink's posts have included manager of the Research Application Dept of the GE Research Laboratory, and general manager of the X-Ray Dept in Milwaukee.

Burger's positions have included general manager of Gear Motor and Transmission Components Dept. He was appointed general manager of the Gas Turbine Dept in 1958. Burens has been president and general manager of GE's affiliate Locke, Inc, and was appointed general manager of the Switchgear and Control Division in 1951. He was elected a vice president in 1954.

BURGER

BURENS

Michaelsen Elected Phelps Dodge VP

Edward H. Michaelsen has been elected vice president of Phelps Dodge Copper Products Corp to head up the company's international activities.

A graduate of Commercial University in Denmark, he held banking positions in Copenhagen, Sweden and England before coming to the United States. He became the first export manager of Phelps Dodge and when a subsidiary of the company, Phelps Dodge Copper Products Corporation International, was formed he became vice president and a director.

One of Collyer's new thermoplastic insulating machines in our new separate department devoted exclusively to the application of high-quality thermoplastics to conductors and assemblies. Facilities include latest equipment for automatic and continuous control of extruding temperatures and dimensions . . . precise let-off and take-up controls to insure uniform product quality.

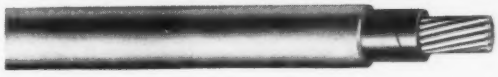
Need Cable? Call on Collyer!

NEW FACILITIES

NEW CABLES

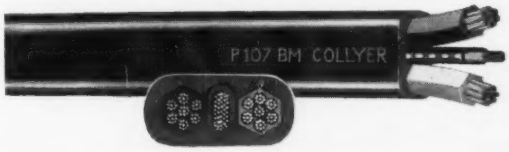
NEW INTERLOCKED ARMOR Cable — Varnished Cambric Insulated — Aluminum or Steel Armored

Flexible, lightweight, easy to handle — cuts installation time, cost and space requirements. No need for rigid conduits. Interlocked Armor assures excellent mechanical protection, reduced outage, continuous operation under heavy loads. Voltages to 15,000.



NEW LIGHTWEIGHT PVC-Sheathed Cable — Varnished Cambric Insulated — PVC Sheathed

Versatile new PVC-sheathed power cable is lighter, less expensive, easier and cheaper to install than lead-sheathed cable. Better moisture protection than braid-covered varnished cambric cable. High resistance to corrosive atmospheres.



NEW PORTABLE POWER Cable with HEX-SHAPED Twin Parallel Conductors —

Heat Resistant Natural Rubber Insulated — Neoprene Sheathed Newly designed *Coal Mining Machine Cable*. Hex-shaped insulated conductors lock conductor assemblies in place to give cable longer flexing life. New Neoprene sheath compound is tougher and more durable, giving greater resistance to abrasion and tearing. Natural rubber insulation adds extra protection against compression cutting.

New Collyer facilities! New Collyer products! Added evidence that Collyer is ready to supply the needs of the electrical industry. Wherever cable must meet highest construction and service standards, it pays to "Call on Collyer." Let us quote on your specific requirements. Write **Collyer Insulated Wire Co., 247 Roosevelt Ave., Pawtucket, R. I.**

LIVE BETTER ELECTRICALLY

Collyer

POWER CABLES • CONTROL CABLES • SWITCHBOARD WIRES
SERVICE CABLES • SERIES LIGHTING CABLES • BUILDING WIRES

NEW!

2½-lb. Pressurized Dry Chemical

5-lb. Pressurized Dry Chemical

Kidde dry chemicals kill more fire faster!

Granted top rating by Underwriters' Laboratories, these two new Kidde dry chemical extinguishers pack the *extra* punch you need to knock out stubborn blazes. These 2½- and 5-pound Kidde units put out as much fire as eight and sixteen one quart carbon tetrachloride portables respectively. They are perfectly balanced for fast action, are light in weight, easy to operate even while wearing gloves. And – no pin to remove, no valves to turn, no inverting or bumping needed. Just aim at fire and press the lever! Pressurized, they can be easily and quickly recharged with air or nitrogen. No pressure cartridge needed. Write for more information on these new Kidde extinguishers – easiest-to-operate dry chemical portables on the market today!

Kidde

Walter Kidde & Company, Inc.
230 Main St., Belleville 9, N. J.
Walter Kidde & Company of Canada Ltd.
Montreal—Toronto—Vancouver

Schuler Made VP-General Manager at Anderson

Anderson Electric Corp has named John H. Schuler vice president and general manager. Prior to his new appointment, he served as vice president and assistant general manager. He will continue as secretary and a member of the board of directors.

Thomas H. Fox will continue as company president, but relinquishes his general managerial duties.

Schuler has been with Anderson since 1945.

Executive VP Named at Chase Brass & Copper

William H. Preston has been made executive vice president of Chase Brass & Copper Co, a subsidiary of Kennecott Copper Corp. He had been sales manager of the mining and construction division of Joy Manufacturing Co since 1953.

Other associations were with SKF industries, and Booz, Allen & Hamilton.

PERSONAL BRIEFS

Don C. Livington has been named manager, Two-Way Radio Sales of Motorola Communications & Electronics, Inc.

I-T-E Circuit Breaker Co. has made **John J. O'Ryan** manager of its Denver district office.

A. B. Chance Co has made two promotions in their Southeastern Region: **W. A. Moss** as commercial vice president, and **Henry F. Jeanes, Jr.,** Southeastern Regional manager.

H. B. Childs has been named administrative assistant by Keasbey & Mattison. **Douglas Graham,** salesman in the Cleveland District, has retired.

W. B. Rankin has been appointed, manager, wiring device sales, The Bryant Electric Co.

Virginia Van Nostrand has been appointed director of home service of Whirlpool Corp.

Nat Currier has been made manager of the Detroit district office of American-Standard, Ross Heat Exchanger Division.

S.B. Lamica has been appointed manager of the Jacksonville, Fla., district of Allis-Chalmers Industries Group.

Sargent Electric Corp has made **George A. Treiber** general sales manager.

testing induction disc relays?

Test any protective device faster with Multi-Amp! Confines instrumentation to a single enclosure, greatly reducing "set-up" time. Safe and entirely portable. Get the facts from Jim Bates by phone or mail!

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Planned Electrical Maintenance Program

MULTI-AMP CORP. LEHIGH AVE. / UNION, N. J.

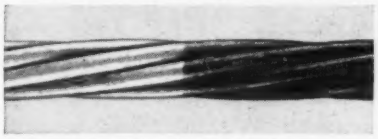
"Continuous power for continuous production"

(ADVERTISEMENT)

Rugged 5-year field test proves superiority of ACCO ALUMINIZED Strand

Convincing proof of ACCO ALUMINIZED Steel Strand's matchless ability to "stand up" in highly corrosive, heavy industrial areas is furnished by a 5-year field test recently completed by a leading Eastern power company.

A section of ACCO ALUMINIZED High Strength Guy Strand, installed in 1953, was removed and subjected to thorough examination, including various laboratory tests and measurements. The wire surface was covered with a formation of sulfide, oxide and soot; but, after scrubbing with soap and water, the aluminum coating was shown to remain *bright, smooth and unattacked* by the highly sulfurous atmosphere (*see photo*).



Loss of weight of the aluminum coating during the 5-year exposure proved negligible. Tests showed that the physical properties of the wire and coating continuity were exceptionally good. All in all, the determinations indicated that the ACCO ALUMINIZED Strand would give *many additional years of outstandingly satisfactory service.*

"Far Greater Life . . ."

In another test, the ability of PAGE ACCO ALUMINIZED Strand to withstand exposure to extreme salt atmospheres is proved, as revealed by the following excerpts from a letter written by an official of a public water authority:

"We have obtained excellent results with ACCO ALUMINIZED guy wire. We ran several tests in the Metropolitan Area where there was exposure to the salt atmosphere from the sea. We used galvanized strand and your (ACCO ALUMINIZED) strand on the same poles.

"Results indicated *far greater life* for ALUMINIZED. After 8 months, the galvanized was rusted, whereas the ALUMINIZED showed no signs of oxidation or deterioration. As a result of our tests, our original purchase of ACCO ALUMINIZED guy wire was followed by another, and larger, order. This wire is used where we must have a product with high resistance to corrosion."

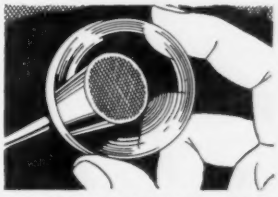
PAGE STRAND

of ACCO ALUMINIZED STEEL

In 1954, PAGE announced to the industry the successful development of a process for combining two time-tested but dissimilar metals, on a production basis, into a revolutionary new wire for increased resistance to corrosion: *Steel* for strength coated with *Aluminum* for corrosion-resistance.

Early laboratory results on accelerated Salt Spray testing which were favorable to ACCO ALUMINIZED over galvanized by a wide margin, are now being confirmed by results of field tests on installations of ACCO ALUMINIZED Strand exposed to the elements over a period of 3 to 5 years. The remarkable performance of the product in both industrial and marine atmospheres is now assured.

Now PAGE offers ACCO ALUMINIZED Steel Strand for guy wire, ground wire and messenger wire. Available in a wide range of sizes, in 3-, 7- and 19-wire construction. It can be used with Preformed Guy-Grip dead-ends made of ACCO ALUMINIZED Wire, or with galvanized pole hardware.



ALL STANDARD GRADES

PAGE ACCO ALUMINIZED Steel Strand is available in Common, Siemans-Martin, High Strength, Extra High Strength, and Utility grades with physical properties meeting ASTM Spec. A-122-54-T and A-363-55-T.

Other PAGE Wires of ACCO ALUMINIZED Steel

ACSR Core Wire

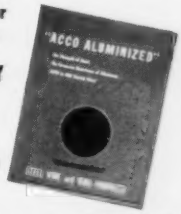
PAGE ACCO ALUMINIZED ACSR Core Wire is now available from leading manufacturers of aluminum conductor cable.

Chain Link Fence

PAGE Chain Link Fence of ACCO ALUMINIZED Steel Wire fabric, provides longer-lasting protection at a long-range saving.

Also . . . ACCO ALUMINIZED Telephone and Telegraph Wire, Barbed Wire —and other products

SEND TODAY for Booklet DH537-A. Write our Monessen, Pennsylvania office



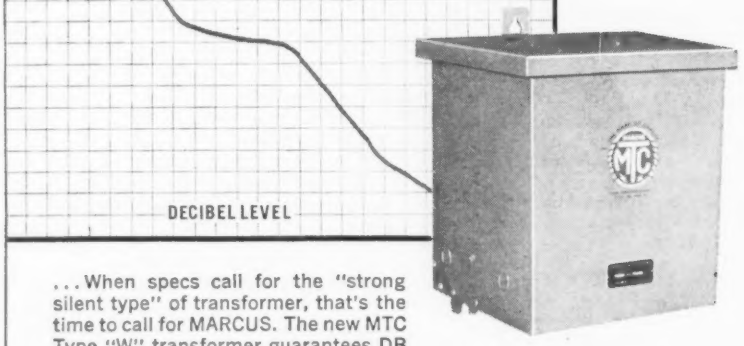
ACCO for Better Values

Page Steel and Wire Division
AMERICAN CHAIN & CABLE

ACCO

Monessen, Pa., Atlanta, Chicago, Denver, Detroit, Houston, Los Angeles, New York, Philadelphia, Portland, Ore., San Francisco, Bridgeport, Conn.

QUIET POWER



...When specs call for the "strong silent type" of transformer, that's the time to call for MARCUS. The new MTC Type "W" transformer guarantees DB LEVELS THAT ARE BELOW NEMA STANDARDS. So for those extra quiet installations, Specify MARCUS---- Proven quieter by independent laboratory test.

- LOWER SOUND LEVELS
- LOWER WEIGHTS
- LOWER INSTALLATION COSTS

MARCUS TRANSFORMER CO., Inc.
RAHWAY, NEW JERSEY
"Mark of Quality"
Representatives in Principal Cities

A COMPLETE LINE OF DRY-TYPE AND LIQUID-FILLED TRANSFORMERS FROM 1 THROUGH 5000 KVA.

Electric Utilities

For our current list of electric utility stocks considered interesting for yield and growth prospects, write or call —

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Private Wire System to Branch Offices, Correspondents and their connections in 100 cities throughout the United States and Canada.

NRECA Meeting

(*Continued from page* 77)

gress will not allow a hike in the 2% interest rate. He angrily rejected claims that such federal aid is "socialistic." He also wants to remove REA from "under the jurisdiction of a Cabinet officer," and put it under an administrator . . . "whose vital interest is in the program."

Another Presidential aspirant, Democratic Sen John Kennedy of Massachusetts, also followed the line opposing any interest rate increase. (Kennedy previously had said, at an NRECA regional meeting last fall in Burlington, Vt., that Congress would provide 1% money, if necessary, to keep REA going.") "Electric power, he said, "is an all-important factor in competition with a ruthless Soviet Union."

Kuchel Hits Trinity 'Partnership'

But if most of the co-op support came from the Democrats, the Republicans were not totally neglected. The leading Republican speaker, other than the President, was California's Sen Thomas Kuchel, who gave the "partnership" policy a verbal setback when he said he would not allow the falling waters of the Trinity River to be developed with federal funds, and the power generated therefrom to be sold to Pacific Gas & Electric, then to be re-sold to the utility's customers. Said Kuchel: "I give you my assurance that Trinity will be completed as a multi-purpose federal project, and that this latest assault on the preference clause . . . will go down to its well-earned defeat."

Ellis and 'Forward Together'

Despite the fanfare of the President's talk, the homey harangue of Lyndon Johnson, the open Presidential bid of handsome Jack Kennedy, nobody put on a better show than NRECA's quick-stepping, passionate, sometimes-belligerent general manager, Clyde Taylor Ellis.

In a 27-page speech characteristically titled, "Forward Together . . . In Rural Electrification," Manager Ellis invoked everything from the words of The Prophet Jeremiah to the Internal Revenue Act of 1954. Calling on the co-ops to make themselves more than merely "fair weather" enterprises, Ellis gave

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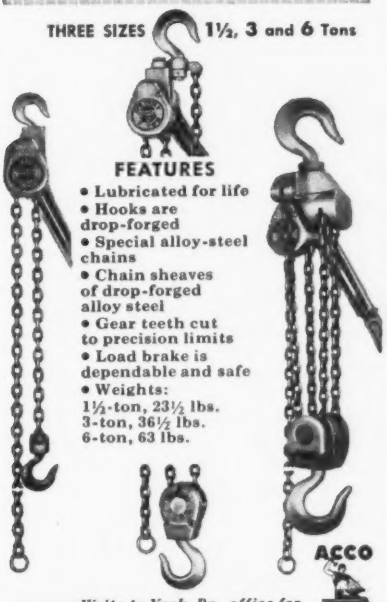

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them an idea of what he thought threatened their existence: ". . . although most our systems exist within a spider web of power company lines, few of us really know what it is like when the spider itself decides to strike and unleash its lethal venom. Verde and Tri-County co-ps in Arizona and New Jersey found out last year." (Incidentally, the Tri-County co-op wasn't even a member of NRECA.)

Ellis, who insists that NRECA is non-partisan and non-profit, went on to outline a score of other political objectives. Most of these were echoed in the 52 resolutions that easily passed the general sessions voting delegation (see box on p 77).

PR and Trust-Fund Plans

Ellis' two most important proposals, however, were not of an immediate political nature, although they may develop political implications. These were for (1) A national public relations and advertising program and (2) a national trust fund into which co-ops would pour their system reserves to "stop waste, provide liquidity and other benefits."

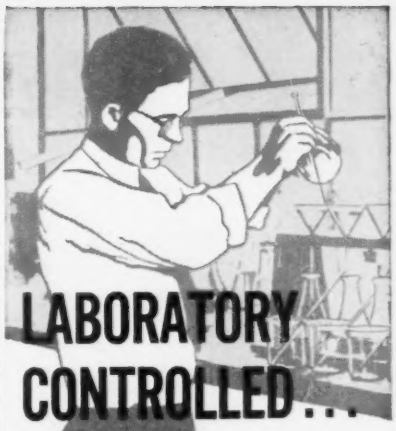
The PR and advertising program, discussed in panels and at the general sessions, envisions the cooperatives pooling their efforts to provide better national and local impact. Here's the way it would work: A co-op having local ad or PR problems, makes a request for help—through NRECA—to the agency, in this case Aubrey, Finley, Marley & Hodgson of Chicago. AFM&H works out a campaign or solution and sends it to the co-op, again through NRECA. The advantages of the plan, as Ellis sees them, are:

- It can be started "baby-size" and be made to grow.
- It gives the co-ops, who would use it on a voluntary basis, the ability to buy expert "know-how," not available to them otherwise.

Aubrey, Finley, Marley & Hodgson's president, Earl Hodgson, and radio director, Dixon Harper, made a presentation before the general sessions based on REA's coming Silver Anniversary. NRECA's public relations committee is now negotiating with the agency.

The second of Ellis' proposals, that for a national trust fund into which member co-ops pour their system reserves is the more interesting,

(*Continued on page* 154)



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NRECA Meeting

(*Continued from p* 153)

and likely to be the more controversial. Ellis outlined it as follows:

The need arises from the threat to co-ops of losing their tax-exempt status. The advantages would be to give the co-ops "the kind of investment efficiency available to big enterprises." It would create a pool that "would be able to invest a reasonable portion of its funds quite soundly in the highest grade 'blue chip' industrial bonds and most of the balance in the highest-yield long-term governments. None of the reserves' principal would be invested in equity common stocks, but for those participants who choose to let their interest accumulate, that interest increment could be invested in high-grade commons as a hedge against inflation."

Ellis lists several other related advantages, but these may be more than offset by what one close observer called "a 2% Achilles' heel." He had in mind the question that both co-ops advocates and adversaries will be asking: How can this trust fund be squared with Ellis' claims that 2% government funds are absolutely essential to the survival of the rural electric systems? It is a good question, and one that will have to be answered by Ellis, the government, or perhaps the co-ops themselves. The NRECA board of directors may have had this in mind when they asked for more study to determine how great the need is for such a program.

Other NRECA meeting subjects included panels on safety, management, sales, legislation and legal problems.

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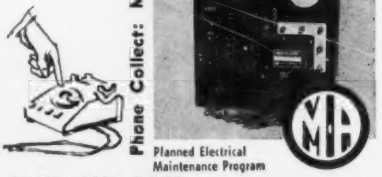

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3	500	Wagner	69,000–460
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2	2500	Wagner	45,800/22,900–4160Y, 3 Ph.
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Readers Forum

"RAD" for "Radioactive"

To the Editor:

With reference to the letter to the Editor in the January 12 issue regarding use of "hot," I would like to suggest R.A.D. shortened to RAD and pronounced with an "a" as in "at." The meaning of R.A.D. or RAD is radio-actively-dangerous.

The coined word was suggested because of the appeal to several diverse groups as is most always the case and the general acceptance of such coined words as "Var" for volt-amperes-reactive.

It will appeal to the "hep" generation because it is short, punchy, and can be humorously coupled with "hot"—to make "RAD HOT." This could be done without losing the significance of it as a danger-conveying term.

Likewise there's a close similarity to RED, which is a term generally accepted as connoting danger. RAD would also appeal to the methodical, saturnine personality as a welcome substitute for the more general term, "hot."

For referring to energized electric conductor, I personally prefer "energized" to "hot" but there are too many fellows working on lines and equipment daily who prefer the short, pungent, punchiness of "hot" for me to suggest changing to the more formal "energized."

W. E. Stewart

1234 Brittain Rd
Akron 10, Ohio

"Electric" vs "Electrical"

To the Editor:

With reference to your query in the correspondence column of the January 12th issue may I suggest the following.

The Oxford English Dictionary defines electric as "Of, charged with, capable of developing, electricity," and electrical as "Relating to electricity."

It seems relatively easy, therefore, to achieve a reasonable consistency as follows:

electric	but	electrical
chair		utility
wiring		manufacturers
energy		associations
power		World
shock		industry
generator		engineer (ing)

It is a moot question whether one can successfully resist the fairly general acceptance of "electrical appliances."

J. J. Knights

63 Munro Boulevard
Willowdale, Ontario

Which Way Do Co-ops Go?

To the Editor:

In your editorial in the November 24th issue of the Electrical World you ask "which way will they go?" Hereabouts the Rural Electric Membership Cooperatives are wanting the 2 percent government money. After paying off their indebtedness on present plant to REA, they want to spend their "profits", and borrowed money, on power plants and transmission lines in competition with private industry. They have no thought of passing up "cheap" government money and they are not paying "patronage refunds" to their customers members.

I have been enjoying your editorials and the new Electrical World makeup.

D. D. Ewing

321 University St.
West Lafayette, Indiana

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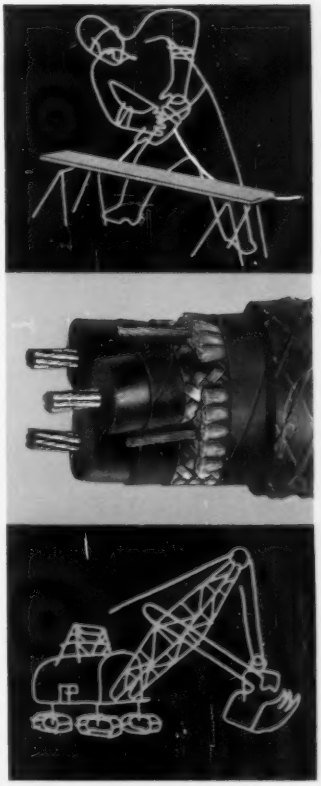

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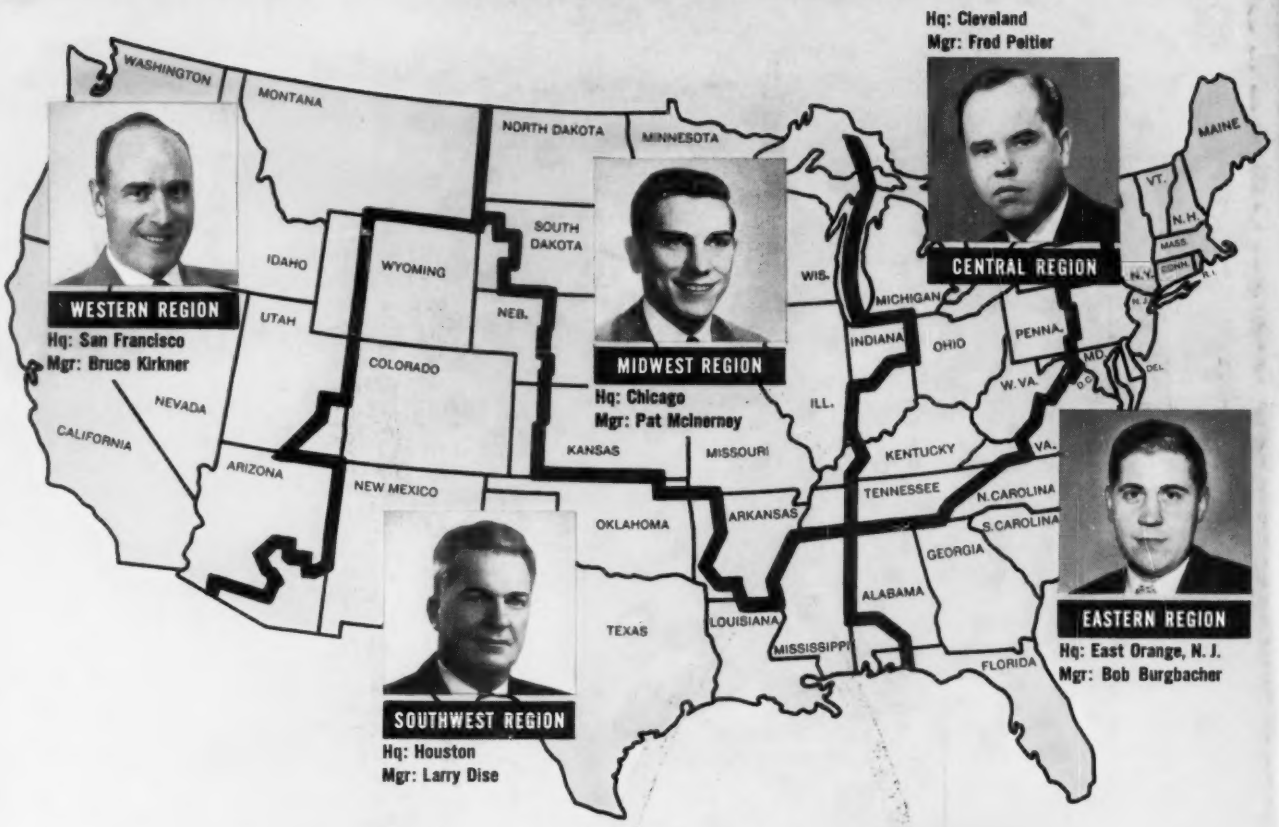

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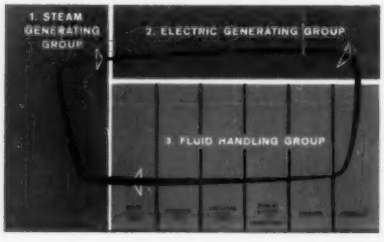

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